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ABSTRACT

This report, published in its entirety (OTA-TCT-578) and in a summary form (OTA-TCT-579) containing only the first chapter of the complete report, focuses on key topics and issues that are central to the successful use of electronic delivery by government. The review conducted by the Office of Technology Assessment concludes that the movement toward electronic delivery of government services is accelerating, but that many factors must be considered. The greatest risks of electronic delivery are overlooking the human element and users' needs, which would further widen the gap between the technologically literate and the technologically illiterate, and failing to capitalize on all the opportunities that partnerships among government agencies and the private sector could provide. Changes that will be required in federal management are outlined, and options for successful implementation of electronic delivery are sketched. Many rely on the amplification of existing structures. Five appendixes complement the complete report, including a list of the 11 boxes, 5 figures, and 22 tables that illustrate the discussion; and lists of acronyms and terms, contributors, field study participants, and contractor reports. The summary volume contains four tables and two boxes. (SLD)

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Electronic Delivery of Federal Services

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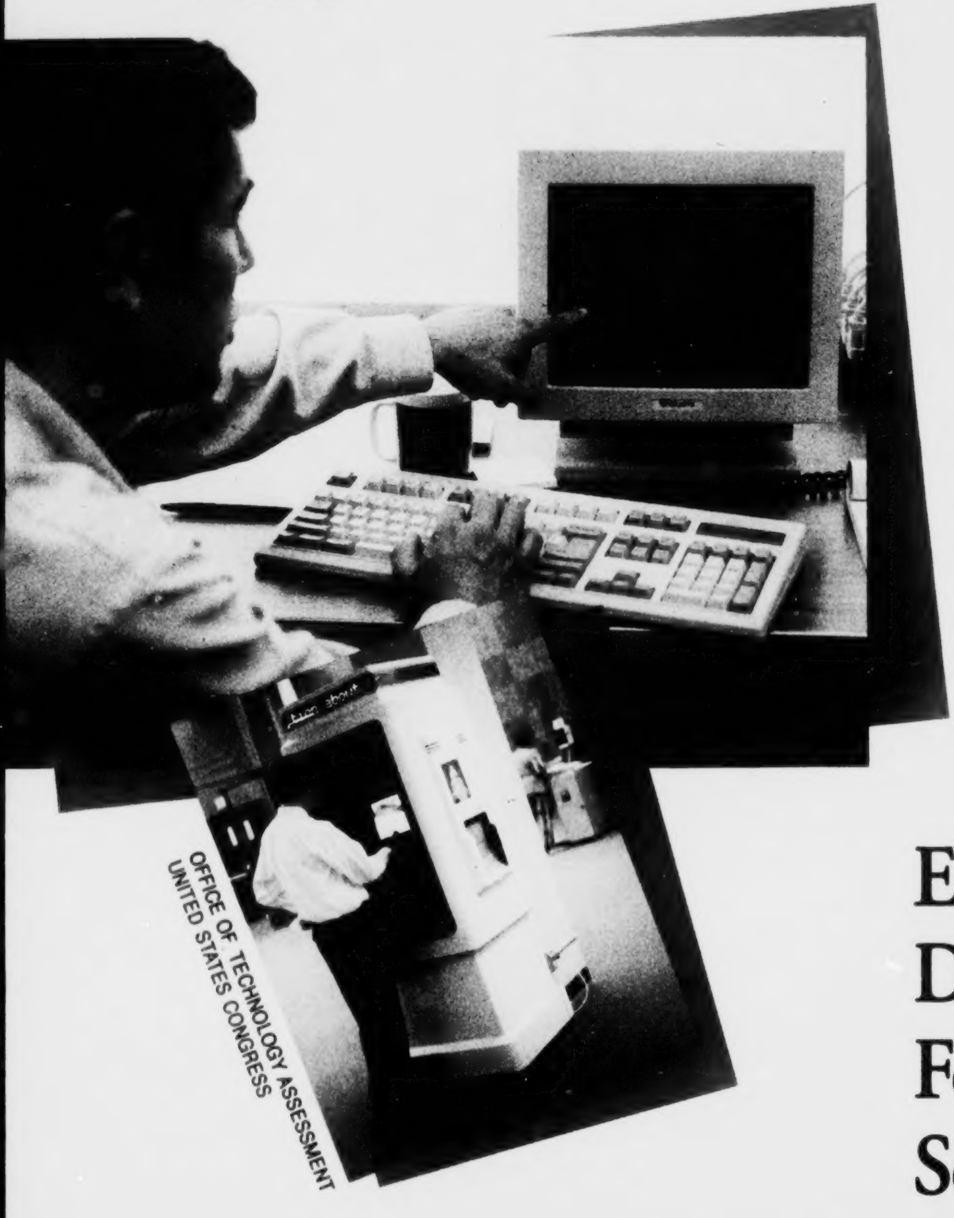

OFFICE OF TECHNOLOGY ASSESSMENT
UNITED STATES CONGRESS

Electronic Delivery of Federal Services

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Foreword

Federal, State, and local governments face the challenge of delivering better services faster and at less cost at a time when demand is growing and budgets are tighter. Computer and telecommunication technologies offer a number of near-term opportunities for delivering Federal services electronically in partnership with State/local agencies and the private sector. To assure that these technologies benefit all citizens—not just the affluent and highly educated—will require Congress to pay special attention to policy and oversight. It will also require agencies to be innovative and skillful in introducing new electronic delivery systems.

OTA's assessment of electronic service delivery was requested by Senator John Glenn, Chairman, Senate Committee on Governmental Affairs. This report provides Congress with alternative strategies for improving the performance of government by using modern information technologies. The report offers new perspectives to Congress as it considers reauthorizing the Paperwork Reduction Act and responds to the administration's "National Performance Review" and "National Information Infrastructure" initiatives. More broadly, the report will contribute to the public debate over the role of information technology in reinventing government.

OTA appreciates the assistance of the project advisory panelists and the interested Federal and State/local government, consumer, public advocacy, library, business, and other private sector groups and individuals who participated in the study. OTA values their perspectives and comments; the report is, however, solely the responsibility of OTA.

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NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by the advisory panel members. The panel does not, however, necessarily approve, disapprove, or endorse this report. OTA assumes full responsibility for the report and the accuracy of its contents.

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Summary of Findings and Options

1

INTRODUCTION

Information technology—computers, advanced telecommunications, optical disks, and the like—can be used by the Federal Government to deliver services to citizens. Most Americans, if they think about it, can identify at least a few Federal services that affect their lives. These include the:[1]

- 46 million recipients of social security benefits,
- 27 million recipients of food stamps,
- 31 million Medicaid recipients,
- 14 million recipients of aid to families with dependent children,
- 15,000 scientists who receive National Science Foundation research grants each year,
- 20,000 small businesses that receive business loans,
- 600,000 persons participating in job-training programs,
- people and organizations that annually place about 1.6 million orders for a total of 110 million publications from the U.S. Government Printing Office,
- citizens who annually receive a total of 10 million pamphlets from the Consumer Information Center,

FRED B WOOD

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[1] U.S. Social Security Administration, "People Served Since 1980," chart, August 1993; Melvina Ford, Library of Congress, Congressional Research Service, "Medicaid: FY1994 Budget," June 30, 1993; Vee Burke, Library of Congress, Congressional Research Service, "Welfare," Jan. 6, 1993; Kenneth Jost, "Welfare Reform," *CQ Researcher*, vol 2, No. 14, Apr. 10, 1992, p. 327; Ann Lordeman, Library of Congress, Congressional Research Service, "Training for Dislocated Workers Under the Job Training Partnership Act," Dec. 3, 1992; U.S. Government Printing Office, "Annual Report: FY 1991," 1992; U.S. National Technical Information Service, "Catalog of Products and Services," 1992; U.S. Small Business Administration, "Annual Report: FY1991," 1992; John Harris, Alan F. Westin, and Anne L. Finger, "Innovations for Federal Service: A Study of Innovative Technologies for Federal Government Services to Older Americans and Consumers," contractor report prepared for the Office of Technology Assessment, February 1993.

- 30,000 or so academic and business researchers who receive research results and technical information each week from the National Technical Information Service, and
- 170,000 citizens who use Federal depository libraries each week.

Services are not limited, however, to monetary benefits, grants and contracts, training and education, or information. Services are defined in this study to include the "service" of making it easier and cheaper for individuals and organizations to: a) find out what Federal services are available and where; b) file documents or pay taxes; and c) participate in the governmental process—including agency and congressional hearings and related administrative, regulatory, and legislative deliberations.[2] Electronic delivery may lead not only to improvements in current services, but to new ways of thinking about and organizing government programs and delivery mechanisms.

Interest in the electronic delivery of Federal Government services (and related State/local services) has mushroomed. Some Federal agencies now use electronic delivery for direct deposit of payments, access to documents and data via computer bulletin boards, and distribution of publications on compact optical disks. Other agencies are conducting pilot tests of: 1) magnetic stripe or smart cards for electronic benefits transfer; 2) videoconferencing for meetings, hearings, and training sessions; and 3) computer networking for "virtual" conferences and the electronic receipt, exchange, and distribution of diverse materials such as schedules, announcements, and reports.

Electronic service delivery is closely linked to the "reinventing government" and "service to the citizen" movements that started at the State and local levels and have spread to the Federal Government. The use of information technology to improve the delivery of Federal services is a major focus of the "National Performance Review" currently being implemented under the direction of the Vice President, and is a key component of the President's "Technology Policy for Economic Growth" and related "National Information Infrastructure" initiatives.[3] Delivering services electronically is now seen as directly linked to improving the Federal Government's service to the citizens of America.

This report focuses on key topics and issues that are central to the successful use of electronic delivery by government. Briefly, the report concludes that:

1. Powerful forces at Federal, State, and local levels are accelerating the movement toward electronic delivery of government services. While information technology offers considerable potential to improve Federal service delivery, there is no assurance that its use will improve access for citizens or result in creative, cost-effective applications unless other factors are considered and dealt with.
2. The greatest risks of electronic delivery are: a) overlooking the human element and the need for affordable, user-friendly applications; b) further widening the gap between the information technology "haves" and "have-nots," and the advantages that educated, technically proficient citizens have over those less so; and c) failing to capitalize on the opportunities for innovation and for economies of scale and scope that would result from partnerships among Federal agencies, their State/local counterparts, and

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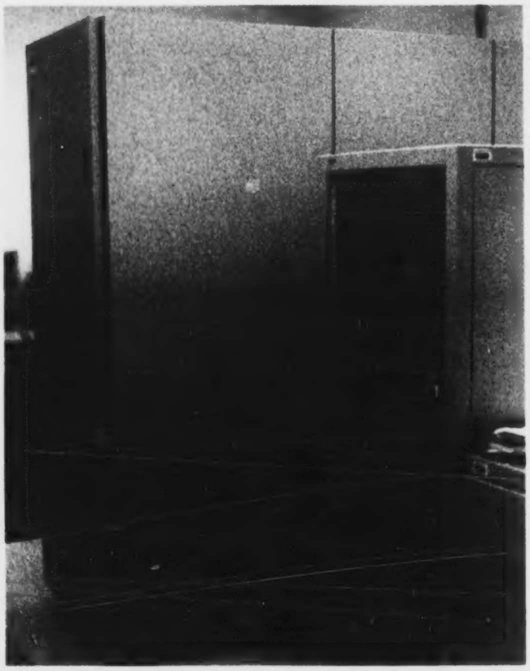
[2] For general discussion of government services, see Priscilla Regan, "Typology of Federal Government Services Relevant to Electronic Delivery," contractor report prepared for the Office of Technology Assessment, January 1992.

[3] Vice President Al Gore, *Creating A Government That Works Better & Costs Less: Report of the National Performance Review* (Washington, DC: U.S. Government Printing Office, Sept. 7, 1993); President William J. Clinton and Vice President Albert Gore, Jr., "Technology for America's Economic Growth: A New Direction to Build Economic Strength," Feb. 22, 1993; and Information Infrastructure Task Force, "The National Information Infrastructure: Agenda for Action," National Telecommunications and Information Administration, Washington, DC, Sept. 15, 1993.



PHOTOS: FRED B. WOOD

***Top left:** Before automation, the State of Washington maintained paper records on about 5 million licensed drivers. The paper-based system was slow, expensive, and cumbersome to use, and required hundreds of feet of shelf space.*

***Top right:** After automation, the State of Washington maintained electronic records on licensed drivers using an optical disk system the size of a large closet. The optical system resulted in significant productivity and service improvements.*

***Bottom left:** Using the optical disk system, the State of Washington is able to respond to a wide range of telephone inquiries in minutes or even seconds.*

the private sector in deploying electronic delivery.

3. The management structure for Federal information technology applications is outdated and needs to be redesigned, as some of the States have already begun to do. This will be a difficult, trying process. Keys to effective management of electronic service delivery include: a) incentives and support for innovation; b) creative thinking in developing "visions" of what electronic delivery could do; c) involvement of both service recipients and agency operational staff at all stages of the project cycle; d) an emphasis on forging strategic partnerships in service delivery; and e) a deliberate, phased program for testing

and evaluating electronic delivery applications prior to full-scale deployment.

4. The telecommunications infrastructure is an essential part of the electronic delivery equation. The Federal Government has not, as yet, clearly linked electronic service delivery needs and opportunities with the capabilities offered by a wide range of private sector telecommunications vendors. For electronic delivery to achieve its full potential, citizens need universal, affordable access to continually advancing telecommunications and computer networking.
5. As the trend toward electronic delivery accelerates, many Federal information policies will become further outdated, increasing the need to update statutes on privacy, security, records management and archiving, procurement, open government, and freedom of information, among others.

FINDINGS ON ELECTRONIC DELIVERY OPPORTUNITIES AND ISSUES

Transition to Electronic Service Delivery Inevitable

The automation of Federal agencies and programs has been under way for three decades. Automation has focused primarily on computerizing internal functions of agencies through the use of mainframe and minicomputers, and, most recently, networked personal computers (PCs). The growth in Federal mainframe computers appears to have leveled off, while the number of PCs exploded from a handful in the early 1980s to about 1 million by 1990, to well over 2 million today.[4] Federal use of new storage technologies also has increased with the proliferation of advanced magnetic and optical disk systems. Use of advanced telecommunications technology has lagged in comparison. Until the mid-1980s, most agencies predominantly used basic telephone service, with more advanced telecommunications limited to the specialized, primarily scientific or technical, agencies. Agency use of telecommunications is now expanding to include facsimile, voice mail, automated telephone response, data communications, computer conferencing, videoconferencing, and the like. Almost all Federal agencies use electronic mail inhouse, and many have some kind of external electronic mail connections.

Congress and the executive branch—regardless of party—have made a commitment, even during tight budget years, to investing in the Federal information technology infrastructure. The Federal information technology budget has grown from roughly $9 billion in fiscal year 1982 to about $25 billion (in current dollars) in fiscal year 1993 for equipment (hardware and software), personnel, and services.[5] The total Federal expenditure since 1980 now exceeds, conservatively, $200 billion. The Federal information technology budget was, until the last few years, split about half and half between civilian and military agencies. The downsizing of the military has shifted the split to about 60 percent civilian and 40 percent military as of fiscal year 1993.[6]

What have the taxpayers received in return? Most Federal agencies now perform many key activities—financial, administrative, technical, and service in nature—that could not be accomplished with paper systems. The sheer volume of applications, filings, programs, and clients would require much larger staffing, if it could be manually handled at all. Agencies such as the Internal Revenue Service (IRS), Social Security Administration (SSA), Bureau of the Census, and National

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[4] Based on GSA and private sector estimates.

[5] Office of Management and Budget, U.S. General Services Administration, and U.S. Department of Commerce, *Current Information Technology Resource Requirements of the Federal Government: Fiscal Year 1993* (Washington, DC: U.S. Government Printing Office, August 1992), see esp. pp. 1-3.

[6] Ibid.

Aeronautics and Space Administration would literally collapse without information technology.[7]

Some agencies, in recent years, have moved beyond internal automation to the application of computers and telecommunications for delivering services and interacting with clients. Electronic deposit of Federal payments, for example, is now commonplace for Federal employees, contractors, and annuitants. The IRS electronic filing program has moved from the pilot to small-scale operational stage. Several major agency automation programs (e.g., at the Patent and Trademark Office and the Securities and Exchange Commission) combine internal automation with electronic service delivery, although frequently with difficulty. The U.S. Department of Agriculture's (USDA's) Food and Nutrition Service is conducting a series of pilot tests of electronic benefits transfer for food stamp and WIC (women, infants, and children) recipients.[8] The Department of Veterans Affairs (VA) and SSA have pilot projects using electronic kiosks for service delivery. The National Science Foundation (NSF) is experimenting with electronic submission and review of grant proposals. And numerous agencies, including the U.S. Geological Survey, National Oceanic and Atmospheric Administration (NOAA), Defense Technical Information Center (DTIC), National Library of Medicine (NLM), National Technical Information Service (NTIS), and U.S. Government Printing Office (GPO), are disseminating Federal information in electronic formats—via bulletin boards, computer networks, and magnetic and optical disks.[9]

The movement toward electronic delivery at Federal, State, and local levels has been accelerated by powerful forces:

- intensified demands for a more responsive, more productive, and less costly government;
- relentless fiscal pressures at all levels of government;
- increasing recognition that service delivery is a core business of government;
- declining cost-performance ratios and growing user-friendliness of information technology; and
- increasing use and acceptance of information technology.

These forces are so strong that the transition toward ever greater use of electronic delivery is inevitable.

Information Technology Opportunities Abound

Recent advances in information technology—especially computers, terminal equipment, telecommunications, and networks—offer new opportunities to implement electronic delivery.

Information technologies could support electronic delivery via: a) personal computers or interactive televisions or terminals in the home, office, or school; b) electronic commerce and electronic exchange of documents with businesses and individuals; c) electronic transfer of Federal benefit payments using magnetic stripe, "smart," or hybrid cards (the latter combine a magnetic stripe and computer chip on a single card); d) electronic

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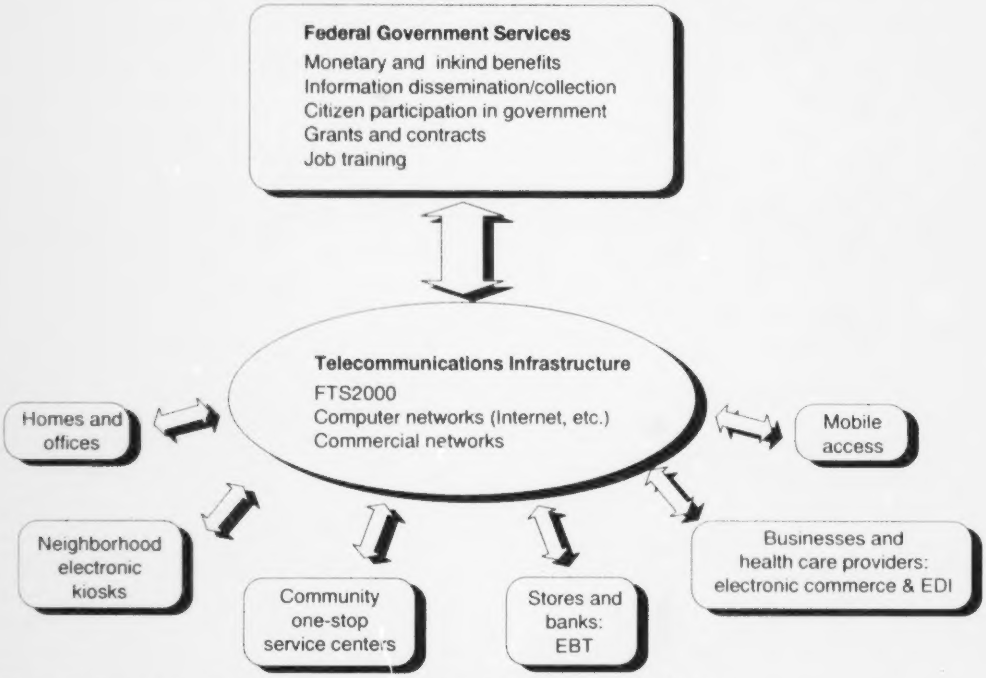
[7] See, for example, John Harris, Alan F. Westin, and Anne L. Finger, "Innovations for Federal Service," op. cit., footnote 1; U.S. Congress, Office of Technology Assessment, *Helping America Compete: The Role of Federal Scientific and Technical Information*, OTA-CIT-454 (Washington, DC: U.S. Government Printing Office, July 1990); Charles M. McClure, Rolf T. Wigand, John Carlo Bertot, Mary McKenna, William E. Moen, Joe Ryan, and Stacy B. Veeder, Syracuse University School of Information Studies, "Federal Information Policy and Management for Electronic Services Delivery," contractor report prepared for the Office of Technology Assessment, Dec. 21, 1992.

[8] See ch. 4 for detailed discussion.

[9] See, for example, Richard Civille, Computer Professionals for Social Responsibility, "Broadening the Research Community: Delivering Federal Services Using Information Technology," contractor report prepared for the Office of Technology Assessment, December 1992; U.S. Congress, Office of Technology Assessment, *Helping America Compete*, op. cit., footnote 7; U.S. Congress, Office of Technology Assessment, *Informing the Nation: Federal Information Dissemination in an Electronic Age*, OTA-CIT-396 (Washington, DC: U.S. Government Printing Office, October 1988).

Figure 1-1—Role of Telecommunications Infrastructure in Delivering Federal Services Via Six Points of Access


Federal Government Services
Monetary and inkind benefits
Information dissemination/collection
Citizen participation in government
Grants and contracts
Job training
Telecommunications Infrastructure
FTS2000
Computer networks (Internet, etc.)
Commercial networks
Homes and offices
Mobile access
Neighborhood electronic kiosks
Community one-stop service centers
Stores and banks: EBT
Businesses and health care providers: electronic commerce & EDI

NOTE: The Federal services and infrastructure components shown are illustrative, not comprehensive.

KEY: EBT=Electronic Benefits Transfer; EDI=Electronic Data Interchange; FTS2000=the Federal long-distance telecommunications program.

SOURCE: Office of Technology Assessment, 1993.

kiosks located at shopping malls or community centers; e) one-stop service centers in suburbs and inner cities as well as small towns; f) mobile service centers in remote or distressed areas; and g) mobile service delivery to field locations using portable terminals—in neighborhoods, on the streets, on farms, and on parklands. Many of these are being pilot-tested today, and some already are in widespread use (see figure 1-1 and table 1-1).

Technologies vary in their state of readiness for use in electronic delivery. Even if technically proven, some technologies may face user, cost, or infrastructure barriers that limit their widespread implementation (see table 1-2). Telefacsimile and computer bulletin boards, for example, are proven technologies that can be implemented on a decentralized basis, but people must have access to a fax machine or a personal computer with a modem to use them.[10] Kiosks, on the other hand, are still in the developmental stage and require further pilot tests and demonstrations. Electronic benefits transfer (EBT), in contrast, already has been extensively tested in the United States and abroad, and is ready for scaled-up, pre-operational testing.

Need for Federal Government Strategy and Vision

The Federal Government lacks an overall strategy or vision of electronic service delivery. As defined here, a strategy contains neither general,

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[10] A modem is a device that converts the digital data from a computer into analog data that can be transmitted over standard telephone lines.

Table 1-1—Illustrative Electronic Service Delivery Activities

Delivery alternative/technology	Illustrative activities
Home/office (status--widespread testing and operations):	
1-800 numbers	IRS "Teletax," INS "Ask Immigration"
Facsimile	NIH "Cancerfax," CA State "Taxfax"
Electronic bulletin board	SBA "SBA On-line," NTIS "FedWorld"
Computer networks	NASA and NOAA scientific databases
Floppy disk	NLM "Grateful Med," USDA "Asian Trade"
CD-ROM	USGS "Gloria," EPA "Toxic Inventory," GPO "Congressional Record"
Electronic kiosk (status--still in small-scale testing):	
Off-line	Phoenix, AZ "At Your Fingertips," Mercer Island, WA, "Island Access"
On-line	Tulare County, CA "Tulare Touch," Long Beach, CA "Auto Clerk," CA State "InfoCal"
One-stop service center (status--still at the conceptual stage):	
Audio- and videoconferencing, electronic mail computer-based services, etc.	Individual technology applications widely tested, but not colocated at identified one-stop centers
Multimedia	DHHS Community Services Network
Mobile delivery (status--widespread but incoherent use):	
Cellular, portable computers, very small aperture earth stations	Individual technology applications widely tested and heavily used, but not as part of an overall strategy
Electronic benefits transfer (status--many tests, limited operations):	
Magnetic stripe card and readers	Reading, PA; Albuquerque, NM; and Ramsey County, MN tests for AFDC and/or food stamp delivery, State of MD operational
Smart (integrated circuit) card readers	Dayton, OH test for food stamp delivery; Casper, WY test for WIC
Hybrid (magnetic + chip) card and readers	No U.S. testing; foreign operational use (e.g., Germany)
Electronic commerce (status--many tests, extensive operations):	
Electronic data interchange (EDI)	Use by Federal agencies for invoices, delivery reports, tariff filings, tax forms, etc.
Electronic funds transfer	Widespread use by Federal agencies for direct deposit, funds receipt and disbursement, etc.
Electronic filing or archiving	Pilot tests, growing use by Federal agencies

KEY: AFDC=Aid to Families With Dependent Children; DHHS=Department of Health and Human Services; EPA=Environmental Protection Agency; GPO=Government Printing Office; INS=Immigration and Naturalization Service; IRS=Internal Revenue Service; NASA=National Aeronautics and Space Administration; NIH=National Institutes of Health; NLM=National Library of Medicine; NOAA=National Oceanic and Atmospheric Administration; NTIS=National Technical Information Service; SBA=Small Business Administration; USDA=U.S. Department of Agriculture; USGS=U.S. Geological Survey; WIC=Special Supplemental Food Program for Women, Infants and Children.

SOURCE: Office of Technology Assessment, 1993.

Table 1-2—Technology Readiness for Electronic Delivery

Delivery alternative/technology	Readiness status
Inhome/inoffice:	
1-800, voice mail	Proven, but must be user-friendly
Facsimile	Proven, but user must have fax machine and touch-tone phone
Electronic bulletin board services (BBS)	Proven, but user must have personal computer and modem, budget for on-line charges, and expertise
Computer networks	Proven, but see above for BBS, plus require network access (possibly at additional cost)
Floppy disk	Proven, inexpensive, but has limited capacity and requires computer
CD-ROM	Proven, price varies widely, high capacity, but requires computer, CD-ROM reader, and expertise
Electronic kiosk:	
Off-line, stand-alone or polled	Proven, cost a function of volume, ready for pre-operational tests
On-line, informational and/or transactional	Developmental, needs further pilot tests
One-stop service center:	
Audio conferencing	Proven, inexpensive, simple to use
Full motion videoconferencing	Proven, but still rather expensive
Compressed videoconferencing	Developmental, costs dropping, ready for pre-operational tests
Desktop videoconferencing	Developmental, needs further pilot tests
Interactive multimedia	Developmental, needs pilot tests
Computer-based services	Colocated, see home/office above
Electronic kiosks	Colocated, see kiosks above
Mobile delivery:	
Cellular	Proven, but still expensive and service areas limited
Portable computers, laptops	Proven, ready for pre-operational tests
Very small aperture terminals	Proven, ready for pre-operational tests
Transportable earth stations	Proven, needs further pilot tests
Transportable kiosks	Developmental, needs pilot tests
Personal communication networks	Developmental, needs pilot tests
Electronic benefits transfer:	
Magnetic stripe cards and readers	Proven, inexpensive, ready for pre-operational tests, large existing commercial infrastructure
Memory cards and readers	Proven, needs pilot tests
Smart (integrated circuit) cards and readers	Proven, but no infrastructure in the United States, still more expensive than magnetic stripe, ready for limited pre-operational tests (plus further pilots)
Hybrid (magnetic + chip) cards and readers	Proven overseas but untested in the United States, needs pilot and pre-operational tests
Optical cards and readers	Developmental, needs pilot tests
Electronic transactions and commerce:	
Electronic data interchange (EDI)	Proven, cost effective, users need computer, software, network access, and expertise
Electronic mail	Proven, cost effective, but see above
Digital facsimile	Proven, still expensive but costs dropping, and see above
Electronic imaging	Proven, still somewhat expensive, and see above
Electronic filing or archiving	Proven, cost effective, and see above
Electronic funds transfer	Proven, cost effective, but requires special equipment (e.g., automated teller machines, point-of-sale terminals, wire transfer network access--can be via banks, etc.)

SOURCE: Office of Technology Assessment, 1993.

vague statements of intent nor overly detailed, inflexible technical or procurement plans. An effective strategy would link goals with technical options and opportunities for service delivery; identify key factors that need attention; and address such issues as user-friendliness, standards, cost, and interagency cooperation as suggested in this report. The strategy would, ideally, describe pictures of what electronic delivery could mean for Americans. The administration's "Technology Policy" and "National Performance Review" initiatives recognize the importance of information technology.[11] The Office of Management and Budget (OMB) has asked executive agencies to submit information on technology projects geared to "service to the citizen," and has supported the General Services Administration's (GSA's) fledgling "service to the citizen" program that involves small-scale educational, outreach, and training activities with some Federal agencies.[12] An overall strategy may emerge from these efforts, but this remains to be seen (as does the quality and completeness of such a strategy).

Without a strategy, many opportunities for technology and program integration, common technical standards and delivery platforms, partnering with State/local governments, and use of off-the-shelf commercial technology may be lost. EBT is a case in point. Pilot-testing and operational use in the United States and abroad have established the feasibility and utility of EBT. But EBT is not likely to be cost effective for delivery of Federal benefit programs if each agency or State goes its separate way. The key to EBT success appears to be a multiprogram, multiagency, Federal/State/private sector collaborative approach. Using EBT to deliver food stamps, for example, involves the USDA; State and local government health or agriculture agencies; food retailers; the banking and electronic funds transfer systems; equipment providers; food stamp recipients; and, in some locales, voluntary community organizations that assist low-income families.

Without a strategy, Federal leadership in electronic service delivery will be in jeopardy. Since the 1950s, the Federal Government has played a major role in the application of information technology for governmental and public sector purposes. Federal contracting for computer systems, whatever its problems, has provided a stimulus to the private sector. In recent years, however, many State and local governments have, in effect, challenged the Federal Government for leadership in the management and application of information technology. Several States—California, South Carolina, and Washington, for example—are developing strategies for electronic service delivery, and the States as a whole are approaching electronic delivery from a more integrated, innovative perspective with a clear priority on improving citizen access than is the Federal Government.[13] Innovation at the local government level is also increasing rapidly.[14] The continuing lack of a Federal strategy could frustrate the ability of the Federal Government to maintain leadership while forming strategic partnerships with State and local governments. This, in turn, could hinder efforts to improve government services since so many Federal programs depend on State/local involvement for implementation. The net result likely would be the failure to capture the full benefits of using information technology to improve the productivity and responsiveness of government service delivery at all levels.

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[11] See Vice President Gore, op. cit., footnote 3; and National Performance Review Accompanying Report, *Reengineering Through Information Technology* (Washington, DC: U.S. Government Printing Office, September 1993). The National Performance Review received input from numerous government and private sector sources. See, for example, National Academy of Public Administration, Center for Information Management, "The Information Government: National Agenda for Improving Government Through Information Technology," July 1993; and Service to the Citizen Intergovernmental Task Force, "We the People: Service to the Citizen Conference Results," June 1993.

[12] See Office of Management and Budget, "Information Resources Management (IRM) Plans Bulletin, OMB Bulletin 93-12, Apr. 28, 1993, esp. app. D; U.S. General Services Administration, Information Resources Management Service, *Service to the Citizens: Project Report*, KAP-93-1 (Washington, DC: GSA, February 1993); Francis A McDonough and Thomas J. Buckholtz, "Providing Better Service to Citizens With Information Technology," *Journal of Systems Management*, April 1992, pp. 32–40; and Jerry Mechling, Jane E. Fountain, and Steven Kelman, *Customer Service Excellence: Using Information Technology to Improve Service Delivery* (Cambridge, MA: Harvard University, John F. Kennedy School of Government, June 1993).

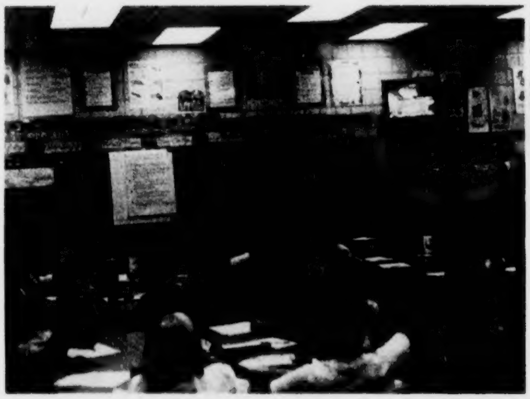
[13] See Office of Technology Assessment, "California Trip Report," and "Olympia/Seattle, Washington Trip Report," Nov. 10, 1992. Also see, for example, Sharon L. Caudle and Donald A. Marchand, *Managing Information Resources: New Directions in State Government* (Syracuse, NY: Syracuse University School of Information Studies, August 1989); State Information Policy Consortium, "National Information and Service Delivery System: A Vision for Restructuring Government in the Information Age," 1992, available from the National Governors' Association, National Conference of State Legislatures, and Council of State Governments; and Council of Governors Policy Advisors, *New Alliances in Innovation: A Guide to Encouraging Innovative Applications of New Communication Technologies To Address State Problems* (Washington, DC: National Governors' Association, 1992).

Risk of Losing the Human Element

Like any new technological application, electronic service delivery will not work if people find the technology confusing, threatening, cumbersome, generally unfriendly, or too costly to use. Electronic delivery runs the risk of losing the human element if it focuses excessively on cost savings, automation, or the technology as an end in itself—rather than on applications that are accessible, user-friendly, private, and secure, as well as cost effective.

OTA site visits found that the grassroots involvement of users—from the pilot-test to full operational stages—helps to assure user-friendly[15] electronic delivery that meets citizen needs. Local schools, libraries, community centers, small-business entrepreneurs, and voluntary organizations help by directly engaging the end-users in the process. The involvement of the local community generally leads to more user-friendly solutions, and gives people a greater sense of commitment and empowerment in harnessing information technology for improved government performance.

The Federal Government can learn from the grassroots experience and reduce the tendency to design unnecessarily large, complex, and expensive technical solutions. Local people and organizations want to be involved and can help keep this tendency in check. When scaling up, high complexity may sometimes be inevitable. But Federal agencies, overall, do not adequately use the local community infrastructure—including schools, libraries, senior centers, and town halls—in developing electronic delivery strategies and systems that are user-friendly and customer-oriented.


FRED B. WOOD

Local schools and colleges can play a key role in delivering services electronically. Here, students at the Benito Juarez Elementary School in El Cerritos, California, participate in a video-on-demand project using fiber optic and coaxial cable networks. Teachers have full remote control and flexibility in using videos to support classroom instruction.

Enhanced Citizen Access Not Assured

Americans have different needs and abilities when it comes to government services and the use of technology. Electronic delivery could result in less equitable access to Federal services for some, despite the promise of the technology to improve access. Pilot tests show, on the one hand, that a broad range of citizens can easily adapt to electronic delivery. Citizens of all ages, races, and income and educational levels are successfully using touch screens, keyboards, or smart cards today—albeit sometimes on a small scale.[16] Computer novices as well as hackers, non-English-speaking as well as English-speaking people, and persons with sight or mobility disabilities as well as the able-bodied all can participate in electronic service delivery programs.

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[14] See, for example, Patricia T. Fletcher, Stuart I. Bretschneider, and Donald A. Marchand, *Managing Information Technology: Transforming County Governments in the 1990s* (Syracuse, NY: Syracuse University School of Information Studies, August 1992); and Information Technology Policy and Management Division, State of South Carolina, *Focus 1990s: Direct Citizen Access Using Modern Technologies* (Columbia, SC: South Carolina State Budget and Control Board, May 1991).

[15] User-friendly technology does not require special training or knowledge of complex keyboard or software procedures.

On the other hand, such participation may be hampered by a major barrier—e.g., the lack of training, equipment, facilitators, and institutional support. Computer networking, for example, could help deliver services to small businesses in the inner city or to Native American craftsmen in rural Montana or Alaska.[17] These business communities could use the technology to their competitive advantage, but to do this, they need access to equipment and networks, a minimal amount of training, and a supportive environment. Support in this case means persons and institutions who can encourage technology innovation, transfer understanding about "how to use the system," and provide some transitional assistance until these entrepreneurs can go it alone. Failure to attend to these needs and opportunities runs the risk that benefits from electronic service delivery would flow more to the suburban, more affluent, and educated segments of society. This would widen the gap between the information technology "haves" and "have-nots."[18]

Cost Effectiveness Not Assured

Electronic delivery could save money for Federal (and State/local) agencies and improve service to recipients, but this is not guaranteed. OTA's review of available cost data and feasibility studies indicates that:

1. Many small-scale decentralized technology applications can be cost effective, meaning that government agencies can provide the same level of service at less cost or more service at the same cost—automated telephone response systems, electronic filing, compact optical disks, and computer bulletin boards are cases in point.
2. Larger scale technology applications require considerably greater levels of interprogram and interagency cooperation and coordination to be cost effective—electronic benefits transfer and electronic kiosks are examples (numerous Federal/State health and welfare agencies issuing their own cards and installing their own networks of kiosks is unlikely to be cost effective).
3. While difficult to quantify (and not counted in official budget figures), electronic delivery offers the prospect of considerable savings to service recipients and intermediaries, especially when the value of their time is included—this has been demonstrated for EBT, computer bulletin boards, and kiosks.
4. If electronic delivery makes services easier to access, it is likely to increase the demand for services that Americans are entitled to. For some services, this could increase the cost to the government. Use of EBT, for example, might stimulate demand by eligible citizens who are not currently enrolled in some Federal programs. The increased cost of these new users might more than offset savings from electronic delivery. Increased use could also lead to longer term savings by reducing the need for government expenditures on underlying health and social conditions (e.g., as with the Women, Infants, and Children Program[19]). Use of electronic bulletin boards

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[16] See examples cited in chs. 2, 4, and 5.

[17] See Office of Technology Assessment, "Alaska Trip Report," and "Montana/Wyoming Trip Report," Nov. 10, 1992.

[18] See, for example, Richard Civille, "The Spirit of Access: Equity, NREN, and the NII," Apr. 15, 1993, available from the Center for Civic Networking, P.O. Box 65272, Washington, DC 20035; and U.S. Congress, Office of Technology Assessment, *Adult Literacy and New Technologies: Tools for a Lifetime*, OTA-SET-550 (Washington, DC: U.S. Government Printing Office, July 1993).

[19] Every dollar spent on the WIC Program is estimated to save the Federal Government about $5 to $10 in later expenditures on child and maternal health problems.

and computer networking, on the other hand, could significantly increase Federal information dissemination at little if any increased cost, and possibly a savings, to Federal agencies.

5. Electronic delivery, even if wildly successful, would have only a modest direct impact on the Federal deficit, since the costs of administering programs and delivering services are generally small compared to the costs of the benefits provided.
6. The largest potential financial benefits of electronic delivery (impossible at this time to estimate) could come indirectly through: a) the restructuring and streamlining of Federal programs and agencies made possible in part by information technology; and b) creatively applying electronic delivery to improve fundamental social, economic, educational, and health conditions in the United States.[20]

Federal expenditures for information technology account for about 1.7 percent of the total Federal budget (5.7 percent of the operating budget).[21] Spending for information technology has been increasing faster over the last decade than the rate of inflation and the rate of increase in the overall Federal operating budget, but is slowing somewhat due to downsizing of the defense budget. Evidence available to OTA suggests that the expectations for information technology to improve cost effectiveness (and service quality) are rational, but not easy to measure or fully realize. This intensifies the pressure to show a demonstrable return on investment, however difficult this might be. Prior U.S. General Accounting Office (GAO) and OTA reports, among others, have highlighted the Federal Government's struggle to keep pace with and understand the effects of technology—given the huge installed base of information technology and systems (estimated at about $50 billion).[22] Despite the best efforts of OMB and various interagency coordinating groups, most agencies proceed with electronic delivery applications largely on their own with little systematic accounting of direct and indirect costs.[23]

▮ Telecommunications Infrastructure Underutilized

The telecommunications infrastructure is an important part of the electronic delivery system. Whether services are delivered to people in their homes, offices, schools, libraries, or shopping malls, most services will depend on the Nation's telecommunications networks to make the connection between Federal agencies and service recipients. The infrastructure includes the public switched telephone network, various private telecommunication and computer networks, cable and broadcast television, satellite-based and mobile communication systems, and a wide variety of value-added networks that lease time on another owner's system. The potential use of the telecommunications infrastructure for electronic delivery of Federal services has received only limited and unfocused attention.

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[20] OTA has initiated an assessment of information technology and the health care system, at the request of the Senate Committee on Labor and Human Resources. See OTA, *Helping America Compete*, op. cit., footnote 7, for discussion of the role of information technology in strengthening the U.S. scientific and technical enterprise; OTA, *Adult Literacy and New Technologies*, op. cit., footnote 18, and U.S. Congress, Office of Technology Assessment, *Linking for Learning: A New Course for Education*, OTA-SET-430 (Washington, DC: U.S. Government Printing Office, November 1989) for discussion of the role of information technology in educating children and adults.

[21] The Federal operating budget excludes transfer payments, mandatory spending programs, and debt service. See Office of Management and Budget, U.S. General Services Administration, and U.S. Department of Commerce, *Current Information Technology Resource Requirements of the Federal Government: Fiscal Year 1993* (Washington, DC: U.S. Government Printing Office, August 1992), see esp. pp. 1–3.

[22] Capital investments account for about one-fourth of the annual Federal information technology budget, or about $50 billion of the $200 billion total cumulative budget over the last decade. GAO has issued hundreds of reports documenting Federal information technology management problems. For a summary, see U.S. General Accounting Office, *Information Resources: Summary of Federal Agencies' Information Resources Management Problems*, GAO/IMTEC-92-13FS (Washington, DC: GAO, February 1992), and *Perceived Barriers to Effective Information Resources Management: Results of GAO Panel Discussions*, GAO/IMTEC-92-67 (Washington, DC: U.S. General Accounting Office, September 1992). Also see U.S. Congress, Office of Technology Assessment, *Federal Government Information Technology: Management, Security, and Congressional Oversight*, OTA-CIT-297 (Washington, DC: U.S. Government Printing Office, February 1986).

[23] See OMB, "Information Resources Management Plans Bulletin," op. cit., footnote 12. Recently enacted legislation will require Federal agencies to establish clear goals against which performance can be measured. See the Government Performance and Results Act of 1993, Public Law 103-62. OTA has initiated a study of the Social Security Administration's information technology automation program, at the request of the House Committee on Appropriations. The Committee request was based in part on GAO's concerns that the SSA had not adequately documented its technology program or developed performance evaluation and electronic delivery plans.

FTS2000

FTS2000 is the Federal program for the bulk purchase of basic long-distance telephone and some advanced telecommunication services from the private sector. All services packaged in FTS2000 are available in the commercial marketplace. The Federal FTS2000 contracts were awarded to two commercial long-distance telecommunications companies. To the degree that FTS2000 becomes a key part of electronic service delivery, then the overall health and future direction of FTS2000 are important.

The transition to electronic service delivery suggests the need to rethink the role of FTS2000. When first conceived, FTS2000 was intended to produce both cost efficiencies and management improvements for Federal telecommunications, compared to the earlier FTS operation. FTS2000 appears to have succeeded against that standard. But over the last decade, telecommunications technology has advanced markedly, and commercial telecommunications companies and services have proliferated. The trend is toward increasingly decentralized applications, which is counter to the centralized decisionmaking and procurement on which FTS2000 is based. Now the Federal Government is on the verge of rethinking its use of information technology, placing much greater emphasis on meeting external customer or citizen needs as contrasted with internal agency requirements. OMB and GSA are taking steps to better understand future agency telecommunication needs.[24] But the role FTS2000 or its successor might play in delivering services to citizens is still largely unknown and unstudied.

Computer Networking

Computer networks are telecommunication systems specially equipped and programmed to link computers and computer terminals at distant geographic locations. Participants in two OTA-sponsored on-line computer conferences confirmed the importance of computer networking,[25] as did OTA contractor research.[26] FTS2000 includes some computer networking services, but these services represent a small percentage of total FTS2000 use. Numerous commercial vendors and some not-for-profit organizations offer computer networking services. The Federal Government has supported the development and operation of computer networks for 25 years, starting with ARPANET for the defense research community and evolving to NSFNET (and its associated networks) for the university research community.[27]

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[24] OMB is surveying agency needs for telecommunication services and technologies currently available, and agency needs for future telecommunication services and technologies. The survey results will be used by the Future Telecommunications Services Working Group, chartered by the Interagency Management Council to assess and define the future direction of FTS2000. See OMB, "Information Resources Management Plans Bulletin," op. cit., footnote 12, app. E.

[25] See Frank Odasz, Big Sky Telegraph, "Computer Conference on Electronic Service Delivery to Rural/Small Town America," contractor report prepared for the Office of Technology Assessment, Jan. 8, 1993; and T.M. Grundner, National Public Telecomputing Network, "The OTA/NPTN Teleforum Project: An Experiment With a Multi-City Electronic Town Hall," contractor report prepared for the Office of Technology Assessment, January 1993.

[26] See Richard Civille, op. cit., footnote 9; Harris et al., op. cit., footnote 1; McClure et al., op. cit., footnote 7; Susan G. Hadden and W. James Hadden, Jr., "Government Electronic Services and the Environment," contractor report prepared for the Office of Technology Assessment, November 1992.

[27] See U.S. Congress, Office of Technology Assessment, *Advanced Network Technology*, OTA-BP-TCT-101 (Washington, DC: U.S. Government Printing Office, June 1993); U.S. Congress, Office of Technology Assessment, *High Performance Computing & Networking for Science*, OTA-BP-CIT-59 (Washington, DC: U.S. Government Printing Office, September 1989); Charles R. McClure, Ann Bishop, Philip Doty, et al., *The National Research and Education Network (NREN): Research and Policy Perspectives* (Norwood, NJ: Ablex Publishing Corp., 1991); Charles R. McClure, Joe Ryan, and William E. Moen, *Public Libraries and the Internet/NREN: New Challenges, New Opportunities* (Syracuse, NY: Syracuse University School of Information Studies, 1992).

PHOTOS: FRED B. WOOD

Top: Computer networking can improve citizen access to Federal Government services. But users must have access to the necessary computer equipment, training, and financial resources. Big Sky Telegraph, headquartered in Dillon, Montana, has pioneered computer networking for rural America.

Bottom: *This map of the United States depicts the computer connections between Big Sky Telegraph in Dillon, Montana, and the rest of the continental United States plus Alaska and Hawaii. Computer networking can help rural areas like Western Montana benefit from electronic delivery of Federal and other government services.*

Much of the federally supported networking community now uses the Internet family of computer networks (actually many separate networks that use common standards for transmitting data among computers).

Computer networking appears to be a viable way to deliver many Federal services electronically if it is accessible and affordable. For citizens who can afford and know how to use computers at home or work, computer networking can open new "electronic doors" to Federal services. But the distribution of computer accessibility is heavily skewed toward the more educated, affluent citizens. Even among the academic research community, computer networking use at present is in transition because the National Science Foundation (NSF) is ending its direct support for Internet—except for high-end use by supercomputing centers—although indirect support through research and institutional grants is likely to continue in some form. The functional equivalent of the National Research and Education Network (NREN) will, in essence, be provided by private vendors, not through a federally supported computer network.

Many Internet users who are federally subsidized are concerned about how this transition will play out. Internet access is not yet part of basic public switched telephone service (nor is it readily available via FTS2000), but is increasingly available from other private computer networking services. From the perspective of electronic service delivery, the key is the provision of widely accessible and affordable computer networking to citizens as part of the Nation's private sector telecommunications and computer infrastructure.

Enhanced Universal Service

For electronic delivery of government services to work on a large scale, all geographic areas of the Nation need to have access to advanced digital telecommunication services, whether these are used to access agency FTS2000 systems, dial-up Internet services, or otherwise connect electronically with Federal agencies. These telecommunication services must be interoperable from one part of the country to another, and among various telecommunication companies, in order to ensure end-to-end electronic connectivity between Federal agencies and their clientele.[28]

Virtually all telecommunication carriers—from the largest Bell operating companies and alternative long-distance providers to the smallest rural telephone companies—are upgrading their plant and equipment. Most are committed to providing all-digital trunk networks with advanced digital switches and high-capacity fiber optic trunk lines by the mid-1990s, if not before. These upgrades reflect, in part, declining equipment costs and increasing competitive pressures.

The larger companies are conducting research and development on advanced digital switching and networking that will ultimately allow interconnectivity among a wide range of end-user equipment for an ever-expanding portfolio of voice, data, image, and video telecommunication services. At the same time, technical advances continue to provide ways to squeeze more sophisticated applications through the old standby—copper wire—that goes into most homes and offices today. Many Federal services could be delivered electronically over the existing public telephone network, and many more could be delivered using integrated digital technologies (e.g., Integrated Services Digital Network—ISDN). The eventual widespread deployment of high-capacity transmission links, such as fiber to the office and curb (and homes, perhaps in conjunction with cable television and other video services), would support more advanced service delivery applications. These might include multipoint videoconferencing, extensive telecommuting, digital libraries, and remote interactive multimedia (e.g., for telemedicine and distance learning).

Electronic delivery of Federal services should evolve to take advantage of new transmission technologies as they become available. At present, however, the Federal Government is not defining—in any coherent or focused way—the telecommunications capabilities needed to support such services. Nor is the Federal Government updating the definition of universal telephone service to reflect advancing telecommunication technologies. Universal, interoperable service is a hallmark of the public telephone system today, and will need to remain so in the future if electronic government service delivery is to be accessible and affordable. These same standards presumably would be applied to any other vendors that become a de facto part of the public switched network, such as cable, satellite, mobile, or computer communication carriers.[29]

Policy and Management Structure Outdated

The Federal policy and management structure for electronic activities includes governmentwide statutes (e.g., the Paperwork Reduction Act and Privacy Act), regulations and guidance (e.g., those issued by OMB and GSA), and the 100,000 or so Federal employees engaged in information policy, management, and operational activities. The structure is increasingly outdated, with a growing mismatch between policy goals and operational realities. Most policies either predate the electronic era or reflect the time when centralized mainframe computers dominated and telecommunications meant "plain old telephone service" (POTS). During the 1980s, Congress modestly updated some of the basic information policy statutes (on privacy, security, electronic surveillance, and information management, for example[30]) to reflect early to mid-1980s technology and applications. The ongoing transition to ever greater levels of agency automation and, most recently, electronic service delivery will create tensions between new applications and the old policy framework.

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[28] See generally U.S. Congress, Office of Technology Assessment, *Critical Connections: Communication for the Future*, OTA-CIT-407 (Washington, DC: U.S. Government Printing Office, January 1990); U.S. Congress, Office of Technology Assessment, *U.S. Telecommunications Services in European Markets*, OTA-TCT-548 (Washington, DC: U.S. Government Printing Office, August 1993); National Telecommunications and Information Administration, U.S. Department of Commerce, *NTIA Telecom 2000: Charting the Course for a New Century*, NTIA Special Publication 88-21 (Washington, DC: U.S. Government Printing Office, October 1988); National Telecommunications and Information Administration, U.S. Department of Commerce, *The NTIA Infrastructure Report: Telecommunications in the Age of Information*, NTIA Special Publication 91-26 (Washington, DC: NTIA, U.S. Department of Commerce, October 1991).

[29] See U.S. Congress, Office of Technology Assessment, *Critical Connections*, op. cit., footnote 28; NTIA, *Infrastructure*, op. cit., footnote 28; Arthur Melmed and Francis Dummer Fisher, *Towards a National Information Infrastructure: Implications for Selected Social Sectors and Education* (New York, NY: New York University, Center for Educational Technology and Economic Productivity, December 1991); K. Kendall Guthrie, "Communication Information Systems: Lessons for a Redefinition of Universal Service," Working Paper, Universal Service for the Twenty-First Century Project, University of Texas at Austin, Winter 1991; Richard Civille, "A Vision of Change: Civic Promise of the National Information Infrastructure," Center for Civic Networking, draft public interest agenda, July 1993; and Ronald D. Doctor, "The National Information Infrastructure Social Equity Considerations," School of Library and Information Studies, University of Alabama at Tuscaloosa, Apr. 13, 1993.

Management of Federal information technology and applications is organized around the Information Resources Management (IRM) concept. IRM is relatively new (little more than a decade old), and was intended to provide an integrated approach to managing the hardware, software, personnel, services, and other components of the government's information technology activities. IRM was not well defined when the Paperwork Reduction Act of 1980[31] was enacted. While IRM was modestly refined by Congress in 1986,[32] it is still unevenly understood and accepted by government agencies. At least at the Federal level, the rapid rate of advance in information technology and applications has made it difficult for IRM to fulfill its original promise.[33] The transition to electronic service delivery will further stress the existing IRM structure and staff, absent significant changes.

The OTA study found:

1. a governmentwide IRM and information management bureaucracy that, despite the best intentions of dedicated individuals, seems trapped in paperwork, minutia, and procedural red tape—with the odds stacked against innovators and visionaries;
2. a governmentwide IRM and information technology planning and budgeting process that, despite recent efforts to accommodate service to the citizen, is still not keeping pace with changes in technology and applications;
3. a massive challenge in retraining many IRM staff to think more creatively about electronic delivery opportunities, better understand and stay abreast of breaking technology developments, and reach out more aggressively to State/local, grassroots, and private sector partners in electronic delivery;
4. continuing confusion or conflict over the roles of agency IRM and program staff, and Washington DC headquarters and field staff, in electronic delivery initiatives;
5. a strong tendency among national agency managers in Washington, DC to develop plans and make decisions without adequate involvement of the field managers responsible for implementing technology and delivering services;
6. lack of technology integration across agency, program, and service lines;
7. lack of integration of Federal services across agency and technology lines;
8. a continuing lack of adequate consultation with end-users—despite an improving trend—when designing and testing electronic delivery systems; and

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[30] See the Computer Matching and Privacy Protection Act of 1988, Public Law 100-503; Computer Security Act of 1987, Public Law 100-235; Electronic Communications Privacy Act of 1986, Public Law 99-508; and Paperwork Reduction Reauthorization Act of 1986, Public Law 99-500.

[31] Public Law 96-311.

[32] Paperwork Reduction Reauthorization Act of 1986, Public Law 99-500.

[33] See McClure et al., op. cit., footnote 7; U.S. General Accounting Office, *Information Resources*, op. cit., footnote 22; Caudle and Marchand, op. cit., footnote 13; and OTA, *Federal Government Information Technology*, op. cit., footnote 22.

9. lack of adequate time and incentives for local agency managers and staff to do strategic planning and "brainstorming" on how to deliver services better—in part using information technology.

OPTIONS FOR MANAGING THE TRANSITION TO ELECTRONIC SERVICE DELIVERY

Congress can affect the rate, nature, and consequences of the transition to greater use of electronic service delivery. The fundamental challenge is to develop a clear Federal strategy that assures that services are delivered equitably, cost effectively, and in keeping with policy objectives.

The executive branch will be largely responsible for implementing electronic delivery at the agency level. Agency activities, in turn, will be guided by the White House, OMB, and other governmentwide policy and management agencies. Congress will review and consider the plans and proposals that result from the ongoing "National Performance Review" and "National Information Infrastructure" initiatives, as well as OMB's continuing information policy activities.

The administration's proposals may include elements that, if acceptable to Congress, would require only continuing oversight rather than explicit legislative or budgetary action. OTA has identified several areas, however, that are likely to need congressional action regardless of executive branch proposals, and other areas that may require action depending on the specifics of executive branch proposals.

▮ Implementing Strategies for Successful Electronic Delivery

OTA identified seven key strategic elements of successful electronic delivery. Collectively, these strategies would constitute the backbone of a governmentwide electronic service delivery initiative. They would, if implemented, represent a considerable shift in emphasis towards a creative, innovative, citizen- or client-centered approach to service delivery. These include:

1. *grassroots involvement* of local citizens and recipients of Federal services;
2. *community infrastructure development* involving schools, libraries, community centers, town halls, and other local agencies that can help facilitate electronic delivery through training, education, and implementation (see box 1-A);
3. *encouraging innovation* by Federal agency employees, clients, and other participants in trying new ways of delivering services electronically;
4. *creating directories* to agency services (including information services and information about other services);
5. *creating alternative futures* for electronic delivery by generating new ideas for the use of information technology and matching electronic opportunities with agency missions;
6. *strategic partnering* between Federal and State/local government agencies; voluntary, not-for-profit, or philanthropic organizations; and commercial companies engaged or interested in electronic delivery; and
7. *pre-operational testing* of electronic delivery systems on a regional or national scale prior to full deployment, including explicit early attention to performance evaluation and policy development.

Congress and the administration could require that these strategic elements be included in all Federal agency plans and budgets for electronic service delivery, and provide agencies with guidance or directives on implementation. Congress could, at a minimum, reinforce the importance of these strategies through general statutory language, and perhaps more specific report language, to accompany the reauthorization of the Paperwork Reduction Act (PRA) and through annual appropriations. The PRA is one of the key governmentwide statutes that provides congressional guidance on Federal use of information technology for agency automation and service delivery. The PRA authorization expired in 1989; sub-

Box 1-A—Using the Community Infrastructure for High Leverage Electronic Delivery

The involvement of the local community infrastructure can greatly facilitate electronic service delivery. The infrastructure, as defined here, includes people and organizations experienced in helping meet the needs of local citizens and/or in training and assisting citizens in using information technology:

- Schools, libraries, community centers, town halls, and hospitals offer some of the most highly leveraged opportunities because these locations are typically heavily used and well respected, and provide a multiplier effect for technology investments.
- At the local level, technologies and locations suitable for multiple users offer the greatest return on investment. The concept of the community communications center has considerable potential to aggregate demand for and uses of electronic delivery at a central, accessible location.
- Local high schools frequently serve this purpose in small towns and rural areas.
- Educational institutions in general—whether high schools, community colleges, or universities—are very interested in using information technology, tend to be more familiar with the technology than the community-at-large, and are well suited to the training needs likely to be associated with major electronic delivery initiatives.
- Schools and hospitals already benefit from ongoing Federal and State computer, distance learning, and telemedicine programs.
- Various voluntary, self-help, and information response and referral organizations are already plugged into the local community, and some receive funding from Federal and State social service programs.
- Small business innovation centers and economic development councils play similar roles for the local business community, typically with partial Federal and State funding.
- The key is to find synergies between these and the many other government programs that collectively can provide the building blocks for electronic service delivery.

SOURCE: Office of Technology Assessment, 1993.

sequent reauthorization efforts have not yet reached fruition but are continuing.[34]

Congress could work with, and monitor, OMB to develop detailed guidance for agency information technology planning and budgeting on electronic delivery. One possible set of directives is illustrated in table 1-3. This example includes specific budget set-asides (as a percentage of agency information technology budgets) for grassroots involvement, community infrastructure development, and innovation—activities that otherwise are likely to be underfunded. This table also includes set-asides for performance evaluation and policy development for pre-operational testing activities—essential for providing the information needed to make decisions on whether and when to commence full deployment.

The congressional committees with governmentwide oversight (Senate Committee on Governmental Affairs and House Committee on Government Operations) may find it helpful to hold annual oversight hearings on electronic delivery activities of Federal agencies. Should Congress determine that OMB and the line agencies are unable or unwilling to adequately fund and implement the electronic delivery strategies, then the oversight committees could work with the appropriate authorizing and appropriations subcommittees to include specific guidance in annual agency funding bills and accompanying report language.

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[34] See S. 681, the Paperwork Reduction Reauthorization Act of 1993, Mar. 31, 1993, S. 560, the Paperwork Reduction Act of 1993, Mar. 10, 1993, and H.R. 2995, the Paperwork Reduction Act of 1993, Aug. 6, 1993.

Table 1-3—Illustrative Guidance to Federal Agencies on Electronic Service Delivery

Success factor	Possible congressional or Office of Management and Budget guidance
Grassroots citizen involvement	Required component of all electronic delivery project plans; 0.25% minimum set-aside from agency information technology (IT) budget
Community infrastructure development	Optional component of project plans; but 0.25% minimum set-aside from agencywide IT budget allocated to infrastructure development
Encouraging innovation	Required agencywide program; 0.5% minimum set-aside from agency IT budget; required participation in innovation clearinghouse
Creating directories	Required; each agency to plan and implement directory (or directories) to agency services and information; required participation in governmentwide directory
Creating alternative futures	Required component of agency annual and 5-year Information Resource Management (IRM) plans
Strategic partnering	Required component of agency annual and 5-year IRM plans; optional component of project plans, but must be considered
Pre-operational (pre-op) testing:	Prerequisite for all medium- to large-scale regional or nationwide electronic delivery systems
Pre-op evaluation	Required component of pre-op testing plans; 5% minimum set-aside from pre-op testing budget
Policy development	Required component; 5% minimum set-aside from pre-op budget

SOURCE: Office of Technology Assessment, 1993.

Assuring Equitable Access to Electronic Services

To have effective access, citizens need to know that services exist and how to obtain them, and be able to make the electronic connections necessary to receive the services on an affordable basis. Assuring equitable access is important to reduce, not widen, the substantial gap between the information "haves" and "have-nots." The distribution of computer resources, for example, is heavily skewed toward the more affluent, educated segments of U.S. society (see table 1-4). Rural and inner city residents, persons with disabilities, and senior citizens are among those who have a lot to gain—or lose—from electronic delivery. Citizens with special needs can be "winners," but only if they are active participants with sufficient technical and financial support.

No single action by Congress or the executive branch will ensure equitable access. Rather, it will come from the combined effects of several actions—starting with a new agency planning and budgeting process that incorporates the strategies discussed above, and emphasizes grassroots involvement, community infrastructure development, and directories.

Congress could affirm its intent that the executive branch develop directories or "electronic road maps" to help citizens identify and locate relevant services. A Federal Information Locator System (FILS) was mandated by the PRA 13 years ago, but is far from fully implemented. Congress could add statutory and report language, when reauthorizing the PRA, that further defines the need for a directory or family of directories to Federal services and information. Federal directo-

Table 1-4–Illustrative Distribution of Citizen Access to Computer Resources

	Percentage of respondents that:	
	Use a computer at work	**Have a computer at home**
Educational level		
Less than high school	10	13
High school graduate	26	19
Some college	43	32
College graduate	58	38
Postgraduate	68	60
Income level		
$ 7,500 or less	10	13
$ 7,501 - $15,000	20	12
$15,001 - $25,000	29	21
$25,001 - $35,000	33	22
$35,001 - $50,000	43	34
$50,001 and over	55	47

SOURCE: Based on a 1990 national survey of 2,254 library patrons conducted by Louis Harris and Associates. For results and analysis, see Alan F. Westin and Anne L. Finger, "Using the Public Library in the Computer Age: Present Patterns, Future Possibilities," American Library Association, 1991.

ries can be implemented using wide-area search and retrieval technologies, as well as electronic bulletin boards and gateways, that allow individual agency directories to function collectively as a "virtual" governmentwide directory.

The cost of electronic delivery can be a major barrier to access. OMB recently issued a revised Circular A-130 on "Management of Federal Information Resources"[35] that prohibits agencies from charging more than the marginal cost of electronic information dissemination, unless explicitly authorized by statute, and permits agency heads to reduce or waive fees if necessary to carry out agency missions or meet the needs of agency clients. Congress could include this provision in a reauthorized PRA, and make clear that the pricing policy applies to electronic delivery of all Federal services—not just information.

Congress also could direct OMB to review all agency activities that might be included in an "electronic public access safety net" to assure access for those citizens who might otherwise fall through the cracks of electronic delivery. The review should cover, at a minimum, the:

- Federal Information Center operated by GSA;
- Consumer Information Center operated by the Government Printing Office (GPO) for GSA;
- Depository Library Program operated by GPO's Superintendent of Documents (SupDocs) in cooperation with about 1,400 participating libraries;
- GPO/SupDocs' "Federal Bulletin Board" and other electronic directory and dissemination initiatives;
- National Technical Information Services' (NTIS') "FedWorld Bulletin Board" and other electronic service activities;
- USDA's "Electronic" Extension Service initiative;

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[35] Office of Management and Budget, Circular A-130 Revised, "Management of Federal Information Resources," *Federal Register*, vol. 58, No. 126, July 2, 1993, pp. 36068–36086.

- other individual agency clearinghouse and information center programs; and
- federally funded information and referral centers or agencies.

Based on the results of this OMB review and the grassroots and community infrastructure involvement, Congress could determine whether other, stronger measures are needed to assure equitable access to electronic delivery. These could include reorganization of existing agency activities and/or the establishment of a partially federally funded, not-for-profit "Corporation for Electronic Service Delivery" or the equivalent.

Reinvigorating Federal Information Resources Management

Significant change is needed to jump-start the Federal IRM bureaucracy to move in new directions that emphasize service to the citizen and electronic delivery. Congress could use amendments to the PRA, or equivalent legislation (e.g., a new "Federal Information Management Act" or "Electronic Service Delivery Act") and accompanying report language, to provide a clear sense of legislative intent by:

- redefining information resources management and training to emphasize electronic service delivery with an end-user or customer orientation;
- strengthening IRM leadership in the agencies (e.g., requiring a full-time senior IRM official or "chief information officer" who participates in top-level agency decisionmaking on service delivery initiatives);
- strengthening the involvement of IRM and agency program staff responsible for service delivery in all stages of electronic delivery initiatives;
- refocusing the Federal IRM organization (e.g., by reorganizing to create new organizational units on electronic delivery within OMB's Office of Information and Regulatory Affairs, GSA's Information Resources Management Service, and the National Institute of Standards and Technology's (NIST's) Computer System Laboratory);
- refocusing the IRM advisory committee structure to help assure that OMB, GSA, NIST, and individual agencies get sufficient input from service recipients, community groups, State/local governments, researchers, and private companies;
- redefining agency annual and 5-year IRM planning to emphasize electronic service delivery (e.g., with specific attention to the electronic delivery success factors—see table 1-3);
- requiring OMB to establish a new, publicly accessible electronic clearinghouse on electronic delivery innovations (possibly as a service of FILS);
- requiring OMB to develop and apply a checklist for successful partnering of Federal and State/local agencies at the exploratory/planning, pre-operational, and operational stages of electronic delivery (see table 1-5 for an outline);

Table 1-5–Illustrative Checklist for Successful Partnering in Electronic Service Delivery

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Exploratory/planning stage

- Project planning task force
- Community workshop or retreat
- Technology demonstration or sharing center
- Local advisory committee

Pre-operational stage

- Cooperative development of operating rules (e.g., assignment of technical and programmatic responsibilities)
- Early resolution of key issues (e.g., cost- and risk-sharing)
- Creative use of requests for information (RFIs) and proposals (RFPs)
- Pilot projects and demonstrations

Operational stage

- Scaling up roles and resources
- Incorporating pilot-test results
- Selecting lead agencies and participants
- Firming up the commitments (and responsibilities) of all partners
- Providing training and user support
- Building in a periodic evaluation component

SOURCE: Office of Technology Assessment, 1993.

- requiring OMB and the Department of the Treasury to develop an electronic benefits transfer plan; and
- requiring NIST to develop an electronic delivery technology plan (e.g., that addresses technical options, user-friendliness, interoperability, standards, and security).

Updating Federal Procurement Practices

As with other Federal information technology activities, some electronically delivered services will be contracted to the private sector, others will be implemented by the agencies, and still others will proceed as part of partnership agreements between Federal agencies, their State/local counterparts, and/or the private sector.

Major procurements for electronic service delivery could further strain a Federal procurement process that is already overly complicated, lengthy, rigid, and unnecessarily expensive. Federal technology managers frequently find themselves locked in by cumbersome procurement practices that leave little room to adapt to technology changes and result in guaranteed early obsolescence of Federal automation programs. Major agency automation initiatives have, in the past, typically taken several years to a decade or more. Procurement strategies that may have worked reasonably well in the 1970s and 1980s are likely to result in automated systems for the 1990s that will be two or three generations of technology behind on the day they become operational.[36] To improve procurement practices, Federal agencies need to:

- take advantage of new breakthroughs in less expensive, off-the-shelf commercial equipment, software, and services;
- use systems that are interoperable with each other and with the private commercial telecommunications and computer infrastructure;
- seek creative opportunities for intra- and interagency procurement partnerships that take advantage of the economies of scale and scope made possible through electronic delivery;
- use procurement strategies that are flexible and evolutionary rather than rigid and static; and
- use information technology to open up competition and cut procurement overhead and red tape.

Congress could direct OMB and GSA to review and revise procurement procedures accordingly. Congress could hold periodic oversight hearings on information technology procurement strategies and practices, and if necessary consider statutory changes and accompanying report language to provide further, stronger guidance.

Congress also needs to monitor the administration's ongoing review of OMB Circular A-76, "Performance of Commercial Activities," to ensure that any change will better balance the sometimes competing considerations of electronic delivery: public accountability, equity of access, government efficiency, public/private sector cooperation, and equity of competition (a "level competitive playing field").

OMB's revised Circular A-130 prohibits agencies from placing copyright or copyright-like restrictions on the use or reuse of Federal information, whether it is provided directly by Federal agencies or by private contractors.[37] The intent is to help assure fair access for both the value-added information industry and the general public. Congress could include this provision in a reauthorized PRA.

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[36] See Thomas Giammo, *Managed Evolutionary Development GUIDEBOOK: Process Description and Application* (Arlington, VA: U.S. Patent and Trademark Office, February 1993); Steven Kelman, Jerry Mechling, and John Springett, *Information Technology and Government Procurement: Strategic Issues for the Information Age* (Cambridge, MA: John F. Kennedy School of Government, Harvard University, June 1992); Armed Forces Communications and Electronics Association, "Evolutionary Acquisition Draft Report," Mar. 12, 1993. For a general discussion of electronic markets and procurement, see U.S. Congress, Office of Technology Assessment, *The Electronic Enterprise: Opportunities for American Business and Industry*, forthcoming.

[37] OMB, "Management of Federal Information Resources," op. cit., footnote 35.

Updating Other Federal Information Policy Statutes

The information policymaking process generally has lagged technological advances and new applications by several or more years. Electronic service delivery provides a framework for balancing the reality of decentralized, dispersed, user-oriented agency automation with the need for some measure of centralized, yet flexible, policy direction and oversight.

The transition to electronic delivery of many Federal services will require a review, and in many cases the eventual updating, of other Federal information policies, including those already discussed above. First priority should be placed on updating the Privacy Act, since electronic delivery that involves personal or financial information will increase the risks to personal privacy. Congress should consider: a) extending the Act to cover non-Federal systems that participate in electronic delivery of Federal services; and b) establishing an independent Privacy Protection Commission or Board to serve informational, ombudsman, advocacy, investigative, and oversight functions concerning the privacy aspects of electronic delivery.

Electronic delivery should provide new opportunities for promoting open government and public access to Federal meetings, records, and archives (while still tightly controlling access to private, proprietary, national security, and other exempted material). Congress could ask OMB and the National Archives and Records Administration to conduct a detailed review of any statutory changes needed to assure that the Freedom of Information Act, Government in the Sunshine Act, Federal Advisory Committee Act, and Federal Records Act are fully applicable to electronic delivery. Congress could likewise ask OMB and NIST to conduct a review of any changes needed in the Computer Security Act, Computer Fraud and Abuse Act, and related statutes to help assure the security of electronic delivery systems.[38]

Using the Telecommunications Infrastructure Better

The telecommunications infrastructure is critical to the success of electronic service delivery, but the infrastructure will be provided largely by the private sector—not by the government. The government and the private sector have a synergistic relationship: greater focus and priority on electronic delivery of Federal (and State/local) services will speed up infrastructure development by the private sector, and vice versa.

FRED B WOOD

This microwave relay station transmits telephone calls and computer data between Anchorage and Fairbanks, Alaska, and is part of the telecommunications infrastructure needed to electronically deliver Federal services to all parts of the Nation.

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[38] OTA has initiated a study on information security and privacy in network environments, at the request of the Senate Committee on Governmental Affairs. Also see U.S. Congress, Office of Technology Assessment, *Privacy Rights in Computerized Medical Information*, forthcoming

OMB and GSA are conducting studies on the future of FTS2000 (the current contract expires in 1998). Congress could redirect this effort so that OMB and GSA: 1) use more creativity in visualizing the potential future role for telecommunications in electronic delivery, and 2) develop more complete and authoritative information for deciding whether and in what form FTS2000 should be extended. Price and service comparisons between FTS2000 and commercial offerings are still incomplete and inconclusive. Congress could direct OMB and GSA to develop a program of agency experiments to conduct more complete and realistic price and service comparisons of electronic delivery using advanced telecommunications. These experiments could be based on technology, agency, program, service, or geography, or some combination thereof.

Congress also could direct that FTS2000 planners specifically address partnering and access questions. For example, if several Federal agencies partnered with the State of California's Info-Cal kiosk project, could FTS2000 be used to provide the long-distance link between users in California and agencies in Washington, DC (or elsewhere around the country)? Or if USDA and the Department of Health and Human Services partnered with their State agency counterparts on a nationwide EBT network, could FTS2000 be used as part of the telecommunications backbone? Or if FTS2000 is brought to Federal agency outposts in rural or remote areas with limited or no telecommunication alternatives, could rural hospitals and schools that receive partial Federal funding use FTS2000?

Whatever the future of FTS2000, Congress should insist on interoperability between FTS2000, agency local area networks, and commercial telecommunication networks. To achieve economies of scale and scope, many electronic delivery scenarios are predicated on interoperability of telecommunication systems across agency, programmatic, and even public/private lines. The more problems encountered with incompatible technical standards when interconnecting FTS2000 systems to each other and the public switched network, the costlier the service and the greater the frustration to providers and users at all levels. The current FTS2000, and all future versions, need to strive for maximum interoperability in order to forestall difficult and costly problems with electronic service delivery deployments. Otherwise, Federal telecommunications will go the way of Federal computer systems—more than two decades worth of computers were installed with widely varying and frequently incompatible software and technical specifications. Intensive Federal and private sector efforts to standardize computer connections will, hopefully, result in interoperable Federal computers, but this will come at great difficulty and expense.

Congress also could ask OMB and GSA, in collaboration with the National Telecommunications and Information Administration (NTIA), Office of Science and Technology Policy (OSTP), and perhaps the Federal Communications Commission (FCC), to:

- review the role of Internet, ISDN, and broadband/fiber to the home/curb in electronic service delivery;
- develop possible revisions to the concept of universal telephone service to include advanced telecommunications and computer networking needed to support electronic delivery; and
- review the administration's computer network and National Information Infrastructure (NII) plans to assure that electronic delivery needs are fully addressed.

Assuring Accessible, Affordable Computer Networking

Access to computer networks could become an addition to the modern version of universal telephone service, whether it be Federal agencies delivering services over the Internet family of computer networks via FTS2000 and other commercial carriers, or citizens receiving Federal services over computer networks via their local telephone company or some other specialized computer network. This approach appears consistent with the President's technology policy, which looks to the private sector for implementation of national computer networks. The emerging consensus suggests that NREN properly refers not to a federally funded computer network like NSFNET, but to a program that relies primarily on the Nation's private sector telecommunications and computer infrastructure—encompassed by the NII concept—for the provision of widely accessible computer networking.[39]

The President's technology plan recognizes the potential links between the NII and government service delivery. Congress could refine and define these links as part of specific proposals for which congressional approval is sought or required. Congress also could explicitly address the links between electronic service delivery and legislation on computer networking and the NII.[40]

Congress traditionally has a special responsibility for assuring equitable telecommunication service to rural and remote areas of the Nation. This responsibility logically would extend to the use of computer networking for the electronic delivery of Federal services to rural America. Rural telephone companies and cooperatives are doing remarkably well in upgrading their plant and equipment. However, while most rural areas now have single-line telephone service, many areas are not yet served by the digital switches and higher capacity trunk lines needed to support advanced telecommunication capabilities. These improvements are being made, but will take at least several more years to complete.[41]

Rural areas can benefit from "rural area networks," or "RANs," set up to achieve the critical mass of users and resources needed to support advanced rural telecommunications—including computer networking. Congress could direct the Rural Electrification Administration and FCC, and possibly OMB, NTIA, and other executive agencies, to ensure that rural and remote areas are included in governmentwide strategies for computer networking and electronic service delivery. Rural communities must have affordable access to a modern telecommunications and information infrastructure if they are to share in the benefits of electronic service delivery, continue to be economically viable, and maintain their role in American life.[42]

Assuring Cost-Effective Electronic Benefits Transfer

After a decade of testing and pilot projects, electronic benefits transfer (EBT) appears ready to take off as a viable alternative to the current paper-based system for delivering many Federal services.

EBT tests and evaluations, using magnetic stripe or "smart" (computer chip) cards, indicate that:

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[39] See U.S. Congress, Office of Technology Assessment, *Advanced Network Technology*, op. cit., footnote 27; U.S. Congress, Office of Technology Assessment, "National Information Infrastructure Initiative: Context for the Future," Telecommunication and Computing Technologies Program Planning Paper, April 1993.

[40] See S. 4, the National Competitiveness Act of 1993, Jan. 21, 1993, Title VI—the Information Technology Applications Act of 1993, as reported out on May 25, 1993, by the Senate Committee on Commerce, Science, and Transportation, and H.R. 1757, the National Information Infrastructure Act of 1993, as approved by the House on July 26, 1993. H.R. 1757, for example, includes the following provisions that are directly relevant to electronic delivery of government services: Connections Program—to foster the creation and connection of local community networks to the Internet, including educational institutions, libraries, and local governments; Training—of teachers, students, librarians, and State and local government personnel in use of computer networks and Internet; Network Security and Privacy—research needed to assure security and privacy of networked transmissions; Ease of Internet Use—research needed to simplify access to and use of Internet by nonspecialists and persons with disabilities; Applications—including networked access to distance learning, telemedicine, digital libraries, and government information; Networked Depository Libraries—to facilitate access to Federal, State, and local government information via Internet; and Federal Information Locator—to be accessible by the public via Internet.

[41] See U.S. Congress, Office of Technology Assessment, *Rural America at the Crossroads: Networking for the Future*, OTA-TCT-471 (Washington, DC: U.S. Government Printing Office, April 1991).

[42] Ibid.

- EBT technology is proven, reliable, easy to use, and decreasing in cost.
- Recipients, retailers, financial institutions, and local program administrators who have tried EBT prefer it to paper.
- EBT can reduce costs to government agencies, retailers, financial institutions, and recipients.
- Recipients using EBT experience an added sense of dignity and security.
- EBT can improve the integrated delivery of several social service benefit payments and simplify the process of issuing and redeeming benefits.
- EBT can reduce fraud and abuse, e.g., for unauthorized or illegal purchases.
- EBT is most likely to be cost effective if it can be used for multiple services and programs and is based on a standardized commercial technology and infrastructure.

Despite these optimistic findings, sufficient information is not available to assure that EBT is cost effective or to make sound technical decisions on nationwide implementation—such as a national rollout of EBT for food stamps using a magnetic stripe card[43] or a nationwide "health passport" using a computer chip card.[44] Federally supported pilot tests have assessed the use of magnetic stripe cards thoroughly, but have given only limited attention to smart cards and have entirely overlooked hybrid cards (that combine features of both magnetic and smart cards).

The next logical step toward nationwide EBT deployment is a scaled-up, multitechnology, multiple-program, and regionally based EBT feasibility test that would help to determine:

- the total cost of developing and implementing a national EBT system;
- the optimal system design (e.g., on-line, off-line, or integrated system; magnetic, smart, or hybrid card);
- the most appropriate deployment strategy;
- the level of Federal/State and public/private cooperation needed to develop and implement EBT cost-sharing and standardized EBT operating rules and procedures;
- the most effective mechanisms for Federal/State leadership and interagency coordination on EBT; and
- the revisions to Federal and State laws and regulations needed to facilitate a transition to EBT.

Congress could direct OMB, the Department of the Treasury, and responsible agencies to design and implement a program of scaled-up feasibility tests. Congress could, if necessary, reinforce this direction through amendments and/or report language to authorization and appropriations bills.

Increasing Congressional Use of Electronic Delivery

In addition to oversight and policy actions, Congress can participate in electronic delivery through its own use of information technology. Several applications are technically feasible and have been pilot-tested, at least on a small scale. These include videoconferencing for committee hearings; electronic bulletin boards for hearing and legislative materials, schedules, etc.; and computer conferences for public input and dialogue. Members of Congress and staff, for example, can now access the Internet computer network; and the House of Representatives has wired several hearing rooms for videoconferencing.[45]

Congress gradually is building the information infrastructure on Capitol Hill that could support electronic service delivery. Ultimately, in addition

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[43] As proposed by the Food and Nutrition Service, U.S. Department of Agriculture.

[44] As is being considered by the White House Health Care Reform Task Force.

[45] Several congressional offices are experimenting with Internet for public access to congressional information. For a general discussion, see Stephen Frantzich, "Electronic Service Delivery and Congress," contractor report prepared for the Office of Technology Assessment, January 1993.

Box B—Illustrative Electronic Connections to the Federal Government

Send electronic mail to the White House:

President Clinton—president@whitehouse.gov via Internet
Vice President Gore—vice.president@whitehouse.gov via Internet
Also available on CompuServe, GEnie, America On-Line, and MCI Mail, among others

Obtain Library of Congress on-line news and event information:

Dial in to the LOC News Service Bulletin Board
202-707-3854 dial-up computer number
202-707-9217 bulletin board operator assistance

Browse the Library of Congress electronic card catalog with 25 million entries—locis.loc.gov via Internet (Mon-Fri 6:30am-9:30pm, Sat 8am-5pm, Sun 1-5pm EST). Includes 15 million entries on books and serials, and 10 million entries on other types of material such as music, software, maps, legislation, copyright registrations, braille, and recorded items.

Check the National Technical Information Service's "FedWorld" Electronic Bulletin Board listing over 3,000 files and providing gateway access to over 100 individual Federal agency databases.

703-321-8020 dial-up computer number
703-487-4608 bulletin board operator assistance

Check the Government Printing Office's "Federal Bulletin Board" for a listing of documents and databases that can be downloaded (free directory access, fees charged for displaying or downloading documents).

202-512-1387 dial-up computer number
202-512-1530 bulletin board operator assistance

Browse the General Service Administration's Clearinghouse on Computer Accommodation Bulletin Board for information on electronic access by persons with disabilities.

202-219-0132 dial-up computer number
202-501-4906 bulletin board operator assistance

Send electronic mail about this report to the Office of Technology Assessment, U.S. Congress—fwood@ota.gov, thausken@ota.gov, egonzalez@ota.gov, or elecdelivery@ota.gov via Internet.

NOTE: As of press time, the Internet and bulletin boards listed above do not charge for access; fees may apply for downloading; users are responsible for their own long-distance telecommunication charges, if applicable. All bulletin board settings are 1,200 or 2,400 bits per second, 8 bit, no parity, 1 stop bit (8N1).

SOURCE: White House, Library of Congress, National Technical Information Service, Government Printing Office, General Services Administration, Office of Technology Assessment, 1993.

to scheduling and status information, complete congressional reports and documents also could be made available electronically. These could include committee reports and hearings, as well as public documents issued by the congressional support agencies—the Congressional Research Service (CRS), Congressional Budget Office (CBO), GAO, and GPO, in addition to OTA. Several of these congressional agencies (e.g., GPO,[46] GAO, and OTA) already are experimenting with electronic dissemination. Taken together, electronic service delivery applications could further open Congress to the people, strengthen the role of Congress as the people's branch of government, and, in the process, set an example for the executive branch and the Nation.

Information technologies offer, in sum, almost limitless near-term opportunities for electronic delivery of Federal services by the government directly or in partnership with State/local agencies and the private sector (see box 1-B for some current Federal electronic connections). New technologies allow electronic delivery to accommodate the diversity of citizens' needs. However, assuring that electronic delivery benefits all citizens—not just the affluent and computer literate—and makes best use of scarce taxpayer dollars will require an extraordinary level of congressional policy attention and oversight and agency execution.

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[46] The Government Printing Office Electronic Information Access Act of 1993, Public Law 103-40, authorizes or mandates a variety of GPO electronic dissemination activities.

Information Technologies for Electronic Delivery

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SUMMARY

Information technologies will offer almost limitless opportunities for electronic delivery of Federal Government services in the near future. OTA identified six electronic delivery "points of access" that are now or will soon be technically feasible using a wide range of technologies. These categories are not exclusive; in fact, several overlapping approaches are often preferable to a single method of delivery, and some technologies can be used in several categories.

FRED B WOOD

1. **Homes and offices.** Services can be delivered directly to the citizen in the home, office, school, library, clinic, and elsewhere via telephones and computers. This direct access may be the most effective in the long term, but only if the services are user-friendly and include helpful directories. Computer-based delivery favors the still relatively small but growing number of homes with personal computers. The Federal Government might therefore need to take steps to assure access to computer-based services in local libraries, schools, and community centers, or via telephones and future interactive television services.
2. **Neighborhood electronic kiosks.** An electronic kiosk is a computer station that combines sound, video, and graphics to provide services in a shopping mall or other central location. Kiosks are accessible after working hours and on weekends. To be effective, a kiosk must offer a valuable service to the public and provide information that is updated regularly. The Federal Government could help promote the standards-setting process for kiosks so that Federal, State, and local agencies could coordinate their efforts and realize economies of scale. The long-term value of kiosks is unclear, however;

many kiosk-based services eventually may be delivered more simply and inexpensively directly to the home, or may be more effective via a one-stop service center.

3. **Community one-stop service centers.** The Federal Government could colocate agency offices that deliver related services so that citizens can go to one location to meet many or all of their service needs. By sharing facilities, agencies could save money and increase their effectiveness. If the logistics of physical colocation are too difficult, agencies could use desktop videoconferencing, for example, to establish a "virtual" one-stop center. An extraordinary level of cooperation among Federal, State, and local governments would be required to make one-stop centers effective.
4. **Mobile access.** To reach citizens who are traveling, in remote or distressed areas, or otherwise isolated, a "mobile service center" could use technologies such as cellular telephones, laptop computers, and satellite receivers to provide services. The Federal Government could fund a pilot project on mobile service delivery in rural or distressed areas where mobile services could be most valuable.
5. **Stores and banks—Electronic benefits transfer (EBT).** EBT includes the use of card technologies to deliver public assistance or other benefits electronically to citizens using automated teller machines (ATMs) and point-of-sale (POS) terminals in stores. EBT promises to reduce theft and fraud in benefit programs, as well as reduce errors, paperwork, delays, and the stigma attached to paper checks and coupons issued by the government for social assistance. Of the many card technologies available, magnetic stripe cards are inexpensive and standardized, and can be used with existing ATMs and POS terminals. Smart cards, with an embedded microprocessor, are more secure and can store much more data than magnetic stripe cards. (EBT implementation issues are discussed in ch. 4.)
6. **Businesses and health care providers—Electronic commerce and electronic data interchange (EDI).** Overlapping with other points of access, electronic commerce includes technologies intended to reduce paperwork and delays, mainly for government-business transactions such as billings, procurements, or regulatory filings. EDI already is saving money for the Federal Government and has well-developed international standards, but agencies are slow to adopt EDI methods.

Federal agencies collectively lack a technology strategy for delivering services electronically. Various Federal agencies, and many State and local governments, are already engaged in electronic delivery, but generally on a piecemeal basis. Congress and the President could oversee the development of a technology strategy to coordinate service delivery among providers. Participants could include, for example, the National Institute of Standards and Technology (NIST), General Services Administration (GSA), National Telecommunications and Information Administration (NTIA), and agency representatives, perhaps working through an interagency committee. This technology strategy could be part of a larger strategy for service delivery discussed in chs. 1, 5, 6, and 7. A technology strategy could both identify technical trends and opportunities and help Federal employees better understand how to conceptualize the use of these technologies for delivering services. It also could facilitate communication through user groups, workshops, conferences, and publications.

A technology strategy emphasizing open systems would encourage procurement of off-the-shelf technologies to benefit from innovation in the marketplace, allow easier upgrades to existing systems, and improve interoperability. Open systems would allow agencies to have greater flexibility in selecting equipment and software, but within an overall governmentwide technical framework. The technology strategy also could coordinate and promote the development of technical standards to help assure that rapidly developing technologies are compatible and cost effective.

To meet citizen needs, a technology strategy should emphasize user-friendly interfaces and directories. Government services can be easily degraded and depersonalized if cutting costs takes priority over assuring meaningful citizen access. Also, electronic delivery intensifies the need to ensure security of the electronic documents and transmissions to make certain that private and proprietary information is protected. Finally, a technology strategy must assure affordable access to advanced telephone and computer-based services so that some citizens are not bypassed by changing technologies (telecommunications infrastructure issues are discussed in ch. 3).

VISIONS OF ELECTRONIC DELIVERY

The following fictional scenarios portray three perspectives of what Federal Government service delivery could be like in the not-so-distant future. The stories are about different people in different situations and how they might actually react to well-designed systems. They also offer a glimpse of how the government "starts over" in its approach to citizen needs, how it forms partnerships with the public and private sectors, how it assures equity of access for disadvantaged and rural citizens, and how it applies different technologies as appropriate.

Starting Over

The first story is about a low-income urban couple in which the husband has recently become disabled. They visit a "one-stop service center" where a social worker uses desktop videoconferencing and expert system software to coordinate their benefits. They later use a card at a local grocery store to receive benefits electronically. It is also a story about a change in the way the government delivers services: starting over.

"I don't know where to begin—everything happened so fast," Jim said to the social worker. After the accident disabled him, Jim and Suzanne had to think about helping him recover, getting her a job, arranging his benefits, and getting help with the children. He had been a self-employed painter, and she took care of the children. He can't work as a painter again, they have no savings, and they don't know what to do. Suzanne remembered hearing about a "one-stop" service center at the hospital that offered all community services in one office. They decided to try it.

After listening to their story, the social worker entered some information into the computer. He doublechecked definitions, asked questions, and let the computer do its own processing to see if he has thought of all the possible options. The benefits range over many agencies, from local and nonprofit groups to Federal providers of social security benefits, tax benefits, veterans' benefits, and food stamps.

This is a new kind of government worker—an information and referral specialist who is cross-trained over many levels of government and outside agencies. While the computer program helps the worker provide correct and consistent answers, it can't think for him. Even the latest software only recites rules and examples or checks logic; it cannot understand the intent or nuances of the regulations. "What is 'training' in this context and what kind of training does Jim qualify for?" the worker wondered. He called a colleague at another service center in the State who knows all about training. This was not a telephone call Suzanne and Jim were familiar with; the worker called by computer. By pointing the electronic "mouse" to icons on the screen and clicking, an image of the other social worker appeared on the computer screen ready to speak with him.

Distributed Services

The social worker explained to Suzanne and Jim that government services—and computers—are more "distributed" today than they were a few years ago. Social workers work more closely with citizens, and they communicate with each other by computer or telephone. They even receive training

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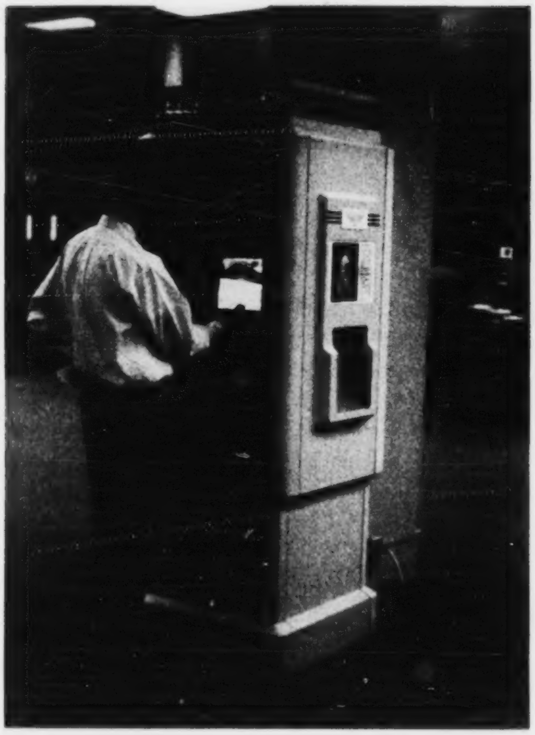

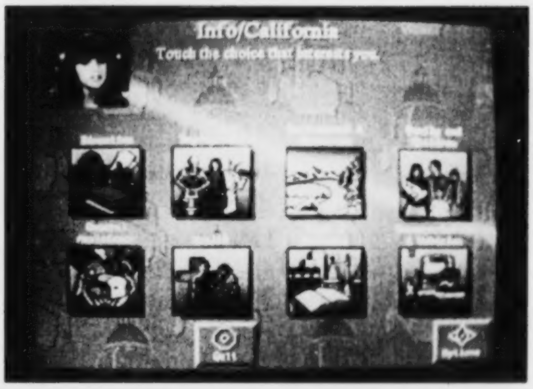

Left: *The InfoCalifornia pilot kiosk located in the main library on the campus of California State University at Sacramento. Other kiosks are located in grocery stores, shopping malls, and government offices.*

Right: *InfoCal kiosks use touchscreen technology to facilitate citizen access to information (in both English and Spanish) on a wide range of California government services—including education, family, health, housing, and employment.*

PHOTOS: FRED B. WOOD

through these or larger videoconferences, eliminating the need for everyone to be in one place. When the one-stop pilot project began back in the 1990s, the computer and videoconferencing equipment weren't compatible among different agencies, but now all the local information and referral workers are connected. Suzanne and Jim didn't really care what "distributed" meant—but the services did seem much more human.

Getting people from different agencies and governments to work together was the real challenge, however. In fact, the pilot project wasn't successful in every State that tried it—every State is different. It required top-level Federal leadership—both congressional and executive—and similar leadership at State and local levels, too. The local leaders were more aware of the specific needs of the community. Innovators were allowed to test their ideas within the basic framework (what the "techies" call an "open system"). The Governor had called the whole process "starting over with government services."

Getting a Benefits Card

The social worker gave Suzanne and Jim a card for getting interim food stamp benefits at the grocery store. The "food card" looks like a credit card. They watched a videotape about it and also tried it a few times in the office. Jim felt somewhat discouraged about depending on others for support. The benefit card looked like just another credit card, though, and Jim felt better knowing that he doesn't need to use paper checks or coupons. The card system is also quicker and easier for the retailer, and the Federal Government benefits because the password cuts down on fraud and stolen benefits.

At the store, the clerk treated them like any other customers. Suzanne put the card through the "point-of-sale terminal." She typed in the password and got a receipt. Suzanne remembered vaguely that the social worker said the card could access different benefits within the same transaction. Today she used a Federal-State program for baby food, cereal, and milk, and a different State-local program for diapers. The card made the determination automatically, debited the accounts, and showed the remaining balances.

Going home, Suzanne and Jim didn't have any forms to fill out, and they didn't have to visit any other offices. They had some information to read, and occasionally Jim will call one of the national 800 or local telephone numbers to clarify a question about his benefits. They may use a kiosk in the neighborhood library—it is accessible for the disabled—that provides information on special needs and local jobs. Suzanne also has heard of interactive television that uses the home television to provide the same information as local kiosks. People also can take classes through such interactive TV services.

The social workers at the one-stop office believe that their services really help people like Suzanne and Jim to work through their difficulties. They also feel that the Federal Government saves money for everyone by helping people where it makes the most difference, avoiding higher costs later, and reducing waste and fraud. The change was not easy, however; "it's like starting over."

Working Together

The next story is about a suburban minority businessman who is using a computer in his tool design shop to do business with the Federal Government. He is using electronic data interchange (EDI) to exchange important information and network with fellow minority businesspeople around the Nation. He hopes to send designs to his clients using the so-called broadband capacity that he can access from his shop.

Daniel has never met most of his colleagues—at least not in the traditional sense. They have helped make his minority business profitable by doing business and exchanging ideas purely through a computer network. His network partners and colleagues live and work all over the country.

He initially bought the computer to do business electronically. All the invoices, bills, and payments are now handled by either the main computer or the backup. Daniel was reluctant at first—he didn't know anything about "electronic data interchange," and he thought it would be expensive. Once he got the contract with the Federal Government, however, he found he could write off much of the cost of the computer and the software. Now he can use it with his other customers too, since it uses the international standard format. Because it is an open system, he can purchase or upgrade whatever equipment and software he chooses, provided it supports the standard format.

"It works like this," he says. "The government keeps its inventory records on its computer. When the inventory of an item is too low, its computer automatically sends my computer a message. When the order is ready to ship, my computer sends a bill back on a toll-free number. After a pre-arranged period, the government computer automatically transfers a payment to my business bank account, and my computer gets a message from them and my bank."

More Efficient Government

The government saves money too because there are fewer errors and inventory is better controlled. The government doesn't only *use* computers; the computers are actually *integrated* with its business partners, public assistance programs, and health care providers. Now Daniel can send in his regulatory, tax, minority business, and other Federal forms using the same system he uses for electronic commerce at no extra cost.

Daniel also sends many of his questions by e-mail directly to the agency: "Who has the time or money to call, only to get a busy signal, be put on hold, or find no one is there because of the difference in time zones?" he asks. "With this e-mail system, when I have a question, I put it out to the agency contact. The contact responds when he or she has a chance to."

Today, it's the only way he can run his business, since his competitors—many of them big companies—are also using this "electronic commerce." "I didn't learn any of this in technical school, except for some basics in computers, and that was a long time ago," he continues. Computers have come a long way since he was in school. Now he does everything just by using an electronic pen—point and click. Well, almost everything. The government requires tight security on many of the transactions; many require his smart card, which he keeps with him, and he has to type in a password and use encryption. For every transaction, his computer also receives a confirmation that the message was received without any errors.

Networking With Colleagues

The electronic commerce application led Daniel to the minority business network, organized by individuals but with on-line assistance from Federal agencies and financial assistance from the Corporation for Public Networking. Other businessmen and women send electronic mail and post to an electronic bulletin board to help each other. For example, when Daniel started plans for a new product, he didn't know how to deal with the forms and regulations for the Department of Labor. He put out an e-mail message asking for help, and someone suggested that he order a CD-ROM on toxic chemicals, which he did. He received names of people in his area who could help him with legal matters. Now he is one of the more experienced contributors, and he helps the newcomers to the system.

Using Broadband Services

Daniel also purchased software to do tool designs on the computer, and sent the designs to the customer's computer over the telephone system. He hopes to expand his business across the country, even overseas. With the new design business, Daniel can use some of the "broadband" telecommunications capacity that he can access from his business. The broadband system sends video and data back and forth between computers very quickly over fiber, copper, or coaxial cable, or via radio.

His daughter also uses broadband. Her teacher can arrange collaborative projects with other classes all over the world, or call up interactive programs from Federal agencies such as NASA. Daniel is more excited about the software that his daughter is using in her design class, however. "The software is now inexpensive enough that my daughter can use this stuff in school," he says. "At least the software companies are finally writing creative software for schools. They realized that there is a big market there if the price is right—and of course there were some government partnerships along the way."

Rural but Not Remote

The final story is about a retired woman who uses on-line systems and CD-ROMs to keep her rural community involved with government. She also has been a patient at the local health clinic where she was treated in part by means of telemedicine. These systems, and another delivering distance education at a local Native American tribal college, all use a technology called narrowband ISDN.

Evelyn says she's always been active, but it used to be with her family or work. Now that she's retired, she's active in her rural community. "Those of us out here far from the major cities need to listen and be listened to—if it's really a democracy, that is," she says. Washington, DC is far away—the local wags say it should be as far away as possible—but even the State capital seems to forget them. As Evelyn says, "If you take all the rural citizens in this country, we add up, and we can help with a lot of the Nation's problems. But rural citizens are not centralized, we're distributed, and that's why distributed communications and government services allow us to participate."

Today she is on-line, scanning recent legislation introduced in Congress and in the State legislature. She calls up the bill on rural schools. She points to an icon, and the full text of the bill

FRED B. WOOD

After the Gold Rush

Compact optical disk reader at the Elmer R. Rasmuson Library on the campus of the University of Alaska at Fairbanks. CD-ROM technology is widely used in university libraries across the country.

appears on the screen. "They amended it," she says to herself, and makes a note to call some of her neighbors. She opens a government directory to search for grants on rural development and information from the Consumer Information Center. She learned to use the networks mostly on her own, since they are now much more user-friendly. She also got help from the librarians in town and from other people on the network, including network assistants at all levels of government. Now she often helps the others.

Evelyn also relies on the newspaper and the television, especially the public television channels that broadcast some of the hearings in Congress and in the State Government. She has a fax machine and occasionally sends faxes to the State capital. Yesterday she went into town to the library, and used a CD-ROM from the Department of Education that provides statistics on rural schools. She's used those CD-ROMs at the library a lot to support the community's position. "Some of the CD-ROM information is also on-line on the Internet, a vast computer network," she says, "but the CD-ROM is cheaper and simpler for me if I'm just looking for statistics."

Using Telemedicine

Evelyn is recovering from a joint ailment that flared up several months ago. Some tests were performed in the local clinic, but one test had to be analyzed by a specialist upstate. Using telemedicine, the clinic sent the data by computer to the upstate hospital, and later the specialist talked to Evelyn and the clinic doctor via a video link. For today's visit, Evelyn will describe how the joint is recovering to both the local doctor and to the specialist upstate watching the live video.

The telemedicine system uses the same ISDN communication that Evelyn uses at home to get her on-line information about Congress. The nurse explains that ISDN is digital and can mix video, data, and voice—something they couldn't do with a single analog telephone line, even though ISDN uses the same pair of wires. "There are a lot of other fancy services out there," the nurse says, "but we can't wait for fiber optics. When we had the opportunity for the pilot project in the mid-1990s, ISDN became affordable and available, and we took advantage of it."

The clinic is the Native American Health Clinic on the reservation. Evelyn doesn't actually live on the reservation, but the clinic is open to residents in the county, including non-Native Americans. Keeping the benefits straight was a chore at first. There are Native Americans from different tribes, other county residents, and all kinds of benefit plans. Now each individual uses a smart card that incorporates all of the plans. The people at the clinic got the idea, and everyone—the Federal, State, and county governments and the tribal leaders—cooperated to initiate a pilot project. They have since modified the system a bit to meet the national technical standards that started to form.

Distance Education

Telemedicine is not the only such partnership on the reservation. The Tribal College has a videoconference room that also uses ISDN transmission for all sorts of training sessions. Students attend classes that the college televises from the other side of the State, and students from high schools on and off the reservation occasionally come in for special programs. Federal, State, and county workers also gather for training sessions from the Departments of Agriculture and the Interior. Evelyn goes there occasionally with others for audioconference meetings with her Congresswoman.

Although equipment is much cheaper today than it was in the 1990s, the cost nevertheless adds up, and any way that they can leverage their tight budget is better for everyone. One big advantage was that the Tribal College could get discount rates for the long-distance teleconferencing using the Federal Government's long-distance contract. It's not a subsidy or free service; they simply pay for long-distance service at the Federal Government rate, which is much better than they could bargain for on their own. "I like the way the Federal Government is doing this," one professor says, "and I don't usually say that. They coordinate and they are partners, but they don't mandate from Washington how we should run things here."

Many in the county feel that the new distributed networks, and the new distributed form of government services, are ideal for their rural community; they help them keep up with urban areas and high technology States. "The change was inevitable," Evelyn says, "but getting government to think in terms of a big, open, distributed system was the hard part—that took leadership. We citizens can do the rest."

POINTS OF ACCESS FOR SERVICE DELIVERY

The previous section speculates about what government service delivery could be like in the future. This section describes six "points of access" where citizens might obtain these and other electronic government services. It also discusses the technologies, trends, and issues related to these access points. The six categories outlined here offer many choices: citizens can receive services at home by telephone or computer, in a local library or service center, or perhaps via a local kiosk in a shopping mall, to name a few possibilities. The points of access also reach different types of citizens—individuals, businesses, the disadvantaged, students and teachers, librarians and researchers, community public interest groups, and others. These categories are not intended to be exclusive; in fact, overlapping approaches are often preferable to one single approach, and often can be sponsored through partnerships. Also, some of the specific technologies apply to more than one category.

■ Homes and Offices

The most convenient and equitable point of access for electronic service delivery would be the home, workplace, school, or local library using technologies such as the telephone or computer (see table 2-1). Home delivery often allows access 24 hours a day and on weekends, and particularly helps Americans who are less mobile due to disabilities, the need to care for dependents, or long distances required to travel to a government office. Distributed service delivery also might help to reduce pollution and traffic, and could encourage telecommuting from home or a neighborhood telecommuting center.[1] Rural electronic networks could provide on-line government information and distance learning for students, and teachers in

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[1] For telework examples and issues, see Jack M. Nilles, "Energy/Environmental Impacts of Electronic Service Delivery: Trends and Innovations," contractor report prepared for the Office of Technology Assessment, November 1991. See also Alan Porter and Scott Cunningham, "Appendix A: A Forecast and Assessment of Telework," in "Private Sector Innovations in Electronic Service Delivery," contractor report prepared for the Office of Technology Assessment, January 1992.

Table 2-1—Home and Office Technologies or Services: Key Characteristics and Selected Applications

Technology or service	Key characteristics	Selected applications
1-800 and 1-900 numbers; voice mail; audiotext; automatic call management, etc.	User-friendly if well designed; very accessible and convenient; some require a touch-tone telephone, others respond to voice inputs; can save money, but often in place of service; expert systems require extensive development; many are not TDD-compatible	IRS's "Teletax" services, SSA's teleservice centers, INS's "Ask Immigration"
Facsimile (fax)	Can submit or receive forms 24 hours a day, but requires access to fax machine; more user-friendly and common than computers; ISDN can speed transmission; fax/modems allow computers to directly send to and receive from fax machines	DOC's EBB/FAX, NIH's "CancerFax," California's "Taxfax"
Dial-up services: Electronic bulletin board services, electronic mail (e-mail)	Can send and retrieve information 24 hours a day, but citizen must have access to computer or terminal with a modem; good for timely information if properly updated; information limited to text; cannot be searched; cost depends on distance and registration fees; user interfaces are not standardized	NTIS's "FedWorld"; SBA's "SBA On-line"; White House's e-mail address; IRS's electronic tax filing
Internet and other network services: BBSs, e-mail, databases	Similar to above, but require Internet access; cost depends on distance to Internet node and channel capacity	FDA's BBS, NASA and NOAA databases, Project Hermes Supreme Court decisions
Interactive multimedia	Still in development; demand greatest in offices, schools, etc.	USGS's Joint Education Initiative (JEI)
CD-ROM	Optical storage; lightweight and easier to search than paper; good for information that does not change frequently; dimensions and format fully standard; requires CD-ROM drive and personal computer; stores 680 Mbytes	National Trade Data Bank and census data, GPO's U.S. Code and Congressional Record, EPA's Toxic Chemical Release Inventory, journals, and newspapers
Floppy disk (diskette)	Magnetic storage; lightweight and inexpensive like CD-ROMs, but are rewritable, contain less data (2 Mbytes), and the drives are more common; disks can be damaged by dust or magnetic fields	USDA's Asian trade information, NLM's "Grateful MED" software, GPO's Medicare pricing table
Television, videotape, radio, print, postal	Timely; far-reaching; serve many languages; widespread use; closed captions exist for hearing-impaired; videotape allows citizen to view when convenient; interactive TV may provide on-line or kiosk features without a personal computer	Emergency services, C-SPAN, education channels, talk shows, newspapers

These technologies are also available in some schools, libraries, and other similar locations.

KEY: BBS=bulletin board system; CD-ROM=compact disc, read-only memory; DOC=Department of Commerce; EBB/FAX= Electronic Bulletin Board/Fax; EPA=Environmental Protection Agency; FDA=Food and Drug Administration; GPO=U.S. Government Printing Office; INS=Immigration and Naturalization Service; IRS= Internal Revenue Service; ISDN=Integrated Services Digital Network; Mbytes=megabytes; NASA=National Aeronautics and Space Administration; NIH=National Institutes of Health; NLM=National Library of Medicine; NOAA=National Oceanic and Atmospheric Administration; NTIS=National Technical Information Service; SBA=Small Business Administration; SSA=Social Security Administration; TDD=Telecommunications Device for the Deaf; USDA= U.S. Department of Agriculture; USGS=U.S. Geological Survey.

SOURCE: Office of Technology Assessment, 1993.

different towns could share information on electronic bulletin boards.[2] Telephone, facsimile, electronic mail, and postal services also can be used to inform government decisionmakers of citizens' interests.[3] Likewise, television, radio, press, and on-line services inform citizens about government decisions.[4]

Even simple on-line computer services and CD-ROMs favor owners of personal computers, however, compared to convenient and equitable toll-free telephone services, mass media, and postal services. Only 17 percent of households own personal computers; only a fraction of those have modems for on-line services, although these numbers should grow.[5] On-line services could bypass those who are not computer literate or who cannot afford computers; the government might therefore need to provide similar services via government offices, electronic kiosks, mobile outreach, or community gatekeepers who, in turn, directly help individuals.

Telephone and Fax Services

Telephone services offer great convenience, flexibility, and cost savings if properly implemented. They include a variety of services provided by attendants and recordings, such as using touchtone input to call up information on the attendant's computer screen before he or she comes on the line, or facsimile (fax) services integrated with computers. If poorly designed or if undue emphasis is placed on cost savings only, however, telephone services can produce long waiting times, inaccurate responses, unwanted voice mail recordings, and other frustrations. Toll (1-800) charges can also be very expensive for the government; 1-900 numbers can recover these costs for certain transactions, but put higher costs on the citizen. Government agencies have only recently enhanced some services to make them accessible to users of TDD (Telecommunications Devices for the Deaf). About 94 percent of U.S. households have telephone service, but not all have touchtone service (although most have touchtone service available).

Mass Media

Mass media services are particularly important because they are already in widespread use: televisions are present in over 96 percent of U.S. households, and videotape players in 72 percent.[6] Cable services promise to be more interactive in the future, possibly allowing on-line computer services through the television set. About 61 percent of households subscribe to basic cable television service and 97 percent can choose to.[7] Citizens who do not have televisions, however, may be particularly isolated, disenfranchised, or disadvantaged and in need of government services.

The mass media can also "legitimate" government services for citizens—particularly isolated

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[2] See U.S. Congress, Office of Technology Assessment, *Rural America at the Crossroads: Networking for the Future*, OTA-TCT-472 (Washington, DC: U.S. Government Printing Office, April 1991); and *Linking for Learning: A New Course for Education*, OTA-SET-430 (Washington, DC: U.S. Government Printing Office, November 1989).

[3] Telephone lines and mail are heavily used to register opinions at the White House and in Congress. In the first eight days of the 103rd Congress, the congressional switchboard received over 1.6 million calls. In January 1993, the White House announced a public e-mail address in addition to the existing public telephone number and postal address. The computer memory was soon filled to capacity as citizens sent e-mail from all over the country. As of March 1993, the computer was receiving an average of 700 messages per day.

[4] The Library of Congress recently made some congressional information available on-line, although full text of legislation or hearing schedules are not available. See Stephen Frantzich, Congressional Data Associates, "Electronic Service Delivery and Congress," contractor report prepared for the Office of Technology Assessment, November 1992. The Government Printing Office Electronic Information Access Enhancement Act of 1993, Public Law 103-40, directs GPO to set up an on-line system for distributing the *Congressional Record* and the *Federal Register* to the public.

[5] U.S. Congress, Office of Technology Assessment, *Adult Literacy and New Technologies: Tools for a Lifetime*, OTA-SET-550 (Washington, DC: U.S. Government Printing Office, July 1993).

[6] Ibid.

[7] Dr. Richard R. Green, Cable Television Laboratories, Inc., written testimony at a hearing before the House Committee on Science, Space, and Technology, Subcommittee on Technology, Environment, and Aviation, Mar. 23, 1993. The data are from A.C. Nielson Co. and Paul Kagan Associates, Inc.

KOTZ-TV in Kotzebue, Alaska, 30 miles above the Arctic Circle. Broadcast and cable television stations in remote areas heavily depend on satellite transmissions to receive programming.

or ethnic populations—in ways that kiosks or service centers cannot. These media act as local partners in delivering information about government services to community leaders. For example, a Native American television station in rural Montana or a Korean newspaper in downtown Los Angeles is often more effective in delivering information about services than the government acting alone.

Bulletin Boards and Computer Networks

Electronic bulletin board systems allow citizens to browse computer menus, files, electronic mail, on-line conferences, or complete on-line forms and transactions via a dial-up telephone call or a nationwide computer network, such as the Internet. Bulletin boards are easy to set up with personal computer equipment and telephone lines, but their contents must be kept current to maintain interest. Bulletin board systems also do not use standard user interfaces.

The 175 or more publicly available Federal bulletin boards[8] often are hard to find. Since early 1993, the National Technical Information Service (NTIS) has operated FedWorld, a bulletin board that, in turn, provides access to over 100 other government bulletin boards. The U.S. Government Printing Office (GPO) maintains the Federal Bulletin Board—a central source for publications and notices from several government agencies.

Government bulletin boards are either free or charge nominal fees;[9] some require registration and a password. Files can be large, however, and the user may have to pay for an expensive long-distance call while the file is transferred (unless the information is provided to a local bulletin board). These long-distance charges can be prohibitive for many citizens. The government could provide toll-free access to government dial-up and Internet services, similar to 1-800 telephone services, to reduce these "metered" communications charges for citizens.

The Internet is a giant computer network woven together from many smaller networks and accessible through commercial and noncommercial providers (see ch. 3). Growth in the number of users has been phenomenal; it currently includes over 100 Federal Government networks of varying sizes, but there is no directory for the government services provided on these networks. More user-friendly applications and interfaces are needed to make the Internet more personal and accessible to those who lack sophisticated computer skills. The government could even provide e-mail attendants or librarians on-line, similar to the attendants used for voice calls. The attendants could respond to questions by e-mail, or by telephone if necessary, to direct the citizen through the network; help with difficult computer instructions; or simply answer questions that bulletin boards and other services do not. E-mail systems could quickly overload the government, however, if installed without thought to the implications for agency workloads.[10]

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[8] Charles R. McClure, Rolf T. Wigand, John Carlo Bertot, Mary McKenna, William E. Moen, Joe Ryan, and Stacy B. Veeder, "Federal Information Policy and Management for Electronic Service Delivery," contractor report prepared for the Office of Technology Assessment, December 1992, p. 38. There were an estimated 30,000 public bulletin boards in the United States in 1990, and perhaps over 60,000 in 1993.

[9] For example, the Department of Commerce's Economic Bulletin Board costs users $35 per year plus per-minute charges, and receives over 10,000 calls per month.

Compact Optical Disks

CD-ROMs[11] are particularly effective for reference materials and searchable databases that can be updated monthly or over longer periods. They are lightweight compared to an equivalent paper document, can be delivered by mail, and often cost $30 per disk or less—over 150 times less per byte than paper. One CD-ROM contains, and can search in seconds, over 5 billion bits of data, the equivalent of an encyclopedia;[12] over 100 full screens of high definition digital images; or a full movie if compressed and shown on a small part of the screen. The CD-ROM industry is highly standardized for physical dimensions and formatting. Table 2-2 shows the time required to transmit the amount of data that can be stored on a CD-ROM using several transmission services.

The government should continue to use CD-ROMs to reduce costs.[13] Agencies can publish CD-ROMs for as low as $800 per master and $2 to $3 per disk, although the full cost is more typically $15 to $100 per disk when development, processing, software, and other production costs are included. In the United States, of approximately 70 million personal computers in homes and offices, over 1 million have CD-ROM drives. The price of these drives has dropped to about $300 from over $1,000. Although there are many more floppy disk drives, penetration of CD-ROM drives is increasing rapidly, and the CD-ROM drives store much more memory (but are not rewritable). WORM (write-once read-many times) and magneto-optic disks use nonstandard formats and therefore are not suitable for publishing. Many techniques, such as animation, exist to implement multimedia using CD-ROMs; no standards have

Table 2-2—Time Required To Transmit Data on CD-ROM

Type of telecommunication service	Rate (bits per second)	Approximate time required
1,200 bps modem	1,200	2 months
9,600 bps modem	9,600	1 week
ISDN	64,000	1 day
T1	1.544 million	1 hour
T3	45 million	2 minutes
SONET OC-48	2.488 billion	2 seconds

Time required to transmit the amount of data that can be stored on a CD-ROM using various telecommunication services. The times are rounded to simplify understanding. One CD-ROM per month is equivalent to a "data rate" of about 1,540 bits per second, or roughly the amount of data that can be transmitted over a 1,200 bps modem running 24 hours per day for 2 months. ISDN, OC-48, T1, and T3 are commercial transmission services.

KEY: bps=bits per second; ISDN=Integrated Services Digital Network; SONET=Synchronous Optical Network.

SOURCE: Office of Technology Assessment, 1993.

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[10] The Santa Monica PEN system includes electronic mail and has increased the workload of city staff. The city, nevertheless, feels that electronic mail and on-line discussions allow the city government to hear from a greater diversity of citizens, and have improved city management.

[11] CD-ROM stands for compact disk with read-only memory. Musical compact disks, or simply CDs, are also read-only, but the ROM designation implies that the CD-ROM is used with a personal computer. To further complicate terminology, WORM (Write-once read-many times memory) refers to similar technology, but is formatted differently.

[12] The *Oxford English Dictionary* is available in 20 paper volumes weighing 137 pounds and costing $2,750, or on one CD-ROM for $875. The CD-ROM can search any of the 615,500 words and 2.4 million quotations in seconds.

[13] Agencies share information through the 6,500-member Special Interest Group on CD-ROM Applications and Technology (SIGCAT), sponsored by the U.S. Geological Survey until 1993.

emerged, however, and the government should take a cautious approach to these new developments.

Interactive Multimedia

Advances in personal computers and broadband communications promise more "interactive multimedia" applications in homes, schools, and particularly offices. The main technological barriers—the need for audio and video processing in personal computers, development of new applications, and standards to help the industry move ahead smoothly—appear to be surmountable. While these multimedia workstations may have great potential for work, education, audio-visual retrieval in libraries, and so forth, it is unlikely that most citizens will need or be able to afford such advanced services in the home in the near future. Demand will likely grow considerably in the mid- to long-term, however.

Neighborhood Electronic Kiosks

Electronic kiosks are interactive multimedia computer stations placed in central locations, particularly shopping malls or one-stop service centers, libraries, post offices, senior citizens' centers, campuses, public housing complexes, and clinics (see table 2-3). Kiosks can substitute for a trip to a government office, several investigative telephone calls, or transactions by mail, and can be accessed after hours and on weekends. They have preprogrammed video and sound like a television; they are user-friendly and may have a printer like an automated teller machine (ATM); and they have graphics and expert system software like a computer. Usually, the monitor is "interactive"; by touching the TV screen, the user can respond directly and simply to the questions posed by the computer. Some kiosks have a slot that accepts credit cards for fee-based services.

Citizens who have difficulty communicating, or are simply curious, may find that requesting information from a kiosk is friendlier than over the telephone or in person. People can browse at any pace or several times if necessary. Many citizens have said they are more comfortable providing personal information to a computer than to a public employee, and feel that the computer treats them more fairly and consistently. Kiosks often provide information in several languages; in Hawaii, for example, the Hawaii Access project operates in English, Samoan, and Ilocano. People also can avoid long waits in line for government services; almost 60 percent of 60,000 queries in the initial State of California InfoCalifornia kiosk pilot program were made after normal working hours or on weekends.

Table 2-3—Types of Electronic Kiosks: Key Characteristics and Selected Applications

Type of kiosk	Key characteristics	Selected applications
Off-line: Stand-alone	For information that does not need updating; no telecommunications costs	GSA's Central Office Building directory
Off-line: Polled	Can update information, and retrieve queries and survey results over a telephone line and modem at night	USPS's "Postal Buddy"; "24-Hour City Hall"
On-line	Can process information immediately; can update rules and software in central computer; requires dedicated telephone line and central computer capacity.	Tulare County, CA's "Tulare Touch"; State of California's "InfoCalifornia"
On-line: Transactional	On-line, but can also collect money via credit or debit cards for bills and services	Long Beach, CA's "Auto Clerk"; State of California's "InfoCalifornia"

KEY: GSA=General Services Administration; USPS=U.S. Postal Service

SOURCE: Office of Technology Assessment, 1993

An important inhibitor is the initial cost required for kiosks. Kiosks used in pilot projects typically cost from $15,000 to $25,000, including hardware, software, and a vandal-proof enclosure. Application development for a kiosk project could cost an additional $50,000 to $200,000 or more. This cost includes customizing the software for the specific application and making video segments for a laser disk. Different agencies and levels of government should share kiosks, therefore, to reduce costs, for the convenience of the citizens, and to avoid competing for space in central areas.

Sometimes costs can be recovered through reduced demands on government staff, however. The Long Beach, CA Auto Clerk system cost about $500,000 and is expected to pay for itself in 2 to 5 years. The U.S. Postal Service estimates that 10,000 proposed "Postal Buddy" kiosks could save $35 million to $50 million on its 42 million address changes each year. The Tulare County, CA "Tulare Touch" cost $3.2 million for 30 kiosks in 6 welfare offices (the kiosks themselves are $15,000 each, plus development costs), and is expected to save at least $1 million per year.[14] Besides reducing staff costs, savings also accrue through reduced errors and improved employee productivity.[15] Reducing routine tasks for agency staff also frees up time to address problems that require special attention.

Critics claim that kiosks often do not fill a significant demand and that frequently the information they provide is not kept current. Some feel that kiosk applications that do not clearly reduce government expenses are not justifiable. Kiosk designs may also exclude visually impaired or deaf citizens, or those who use wheelchairs; thorough planning and standards are needed to ensure that kiosks are designed to meet the needs of most potential users.

Another inhibitor is that kiosks are not standardized, making it difficult for Federal agencies to share kiosks. State and local governments increasingly are using kiosks to combine services,[16] but use different designs and do not all accept information in the same format. The Federal Government could provide information to these State and local kiosks in a common or standard format, similar to providing CD-ROMs in a standard format suitable for libraries. Federal agencies could distribute these standard packages at cost through NTIS, GPO, or another agency. Commercial vendors may be in the best position to standardize the kiosk operating systems, since the industry is developing quickly. The government could collaborate with industry in developing a standard format through the National Institute of Standards and Technology (NIST) or an interagency committee.

Instead of multipurpose kiosks, businesses and the Federal Government are testing kiosks for specific niche applications. The U.S. Postal Service's "Postal Buddy" makes address changes, dispenses stamps, and provides other postal services. The Department of Veterans Affairs and the Social Security Administration are pilot-testing kiosks for service delivery, and are collaborating with the Postal Service on a multiagency kiosk. The success of such Federal kiosk programs is unclear.

Community One-Stop Service Centers

The One-Stop Concept

In many cases, the Federal Government could consolidate its service delivery into centers shared by related agencies, including State and local government agencies.[17] In this way, agencies could share expensive technology not otherwise affordable, and gain synergy from improved cooperation (see table 2-4). For the recipient, such centers save effort, reduce the "run-around," and provide more complete, better quality services. The service center could be in a Federal building, city hall, or other convenient location as space and budget allow. Agencies can fully colocate their offices, simply send representatives to an appropriate location to help the public directly, or have a "virtual" one-stop center using desktop conferencing.

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[14] The savings in staff time are considerable. The kiosks currently process 83 percent of their 45,000 Aid to Families with Dependent Children (AFDC) cases and 16,000 food stamp cases, and the county intends to add 30,000 MediCal cases to the system. The county receives 250 to 350 applications per day, with each application requiring from 15 minutes to 2 hours of staff time.

[15] For example, although error rates are difficult to quantify, the Tulare Touch staff found that the error rate from staff processing on welfare submissions dropped from 38 percent before using kiosks to zero after kiosks, based on 200 cases tested with each system. Tulare Touch is also credited with reducing staff turnover from 37 percent to 12 percent.

[16] Public Technology, Inc. has helped to implement several "24-Hour City Hall" projects in partnership with IBM. Examples include the Phoenix, AZ "Phoenix at Your Fingertips," and the Kansas City, MO "City Hall in the Mall." Public Technology, Inc. is a nonprofit arm of the National League of Cities, the International City-County Management Association, and the National Association of Counties.

The main concept behind the one-stop service center is not technological, but one of public administration—it makes government more human and personal. Considerate, human contact between agency representatives and citizens is very important. If one agency cannot help a citizen, the employee can direct the citizen to the appropriate agency "down the hall." Agencies working together can avoid traps that catch unwary citizens who do not receive appropriate assistance. Hillsborough County, FL; Boston, MA; and the State of Delaware have established one-stop shopping methods for medical care.[18] Similar coordination is the aim of the Department of Agriculture's "Infoshare" program. The City of Everett, WA, placed an office in a shopping mall ("City Hall at the Mall") for citizens to pay bills

Table 2-4—One-Stop Service Center[a] Technologies: Key Characteristics

Technology	Key characteristics
Audio conferencing	Simple; relatively inexpensive; sufficient when no data or graphics are presented
Room-scale videoconferencing—wideband	Full-motion analog (6 MHz) one-way or two-way transmission; best for one-to-many applications like distance education; two-way transmission cost is decreasing, but is still expensive for small groups due to setup cost
Room-scale videoconferencing—compressed	Uses compression algorithms to reduce video bandwidth to 64 to 768 kbps depending on application; transmission is one-to-one, one-to-many, many-to-many; audio may not be synchronous; good for distance education or meetings; users include Congress, EPA, GSA, DoD; equipment costs about $30,000 to $60,000 per location, and cost is decreasing
Desktop text- and videoconferencing and multimedia	Combine personal computers and video compression; bandwidth can be reduced to 64 or 128 kbps using ISDN or LANs; excellent for text-conferencing, video image is small and jerky; equipment costs about $5,000 per location and is decreasing
GIS, telephone systems, etc.	Agencies can consolidate and share equipment such as GIS, PBX telephone-switching equipment, or FTS2000 capacity
Kiosks	Can process citizen inquiries
CD-ROMs, on-line services, etc.	Provide access for those who do not have personal computers; may require attendant to help users

[a] The one-stop center here is not synonymous with a kiosk; the center may or may not include a kiosk.

KEY: CD-ROM= compact disk, read-only memory; DoD=Department of Defense; EPA= Environmental Protection Agency; FTS2000=the Federal long-distance telecommunications program; GIS=Geographical Information Systems; GSA=General Services Administration; ISDN=Integrated Services Digital Network; kbps=kilobits per second; LANs=local area networks; MHz=megahertz; PBX=public branch exchange.

SOURCE: Office of Technology Assessment, 1993.

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[17] Some people refer to electronic kiosks as one-stop centers, but a distinction is made in this report. Here, a one-stop service center might include a kiosk as part of its services.

[18] National Commission to Prevent Infant Mortality, "One-Stop Shopping for Infants and Pregnant Women," *Public Welfare*, vol. 50, No. 1, winter 1992, p. 26.

and carry out other transactions.[19] Several other countries have various degrees of one-stop centers in place, including Canada's InfoCentres and Business Service Centres, Denmark's "electronic cottages," and France's "single window" project.[20]

In addition to office expenses and videoconferencing costs, agencies also could share costs for upgrades to local telecommunications equipment such as PBX switches, or geographic information systems (GIS) for resource management and other uses. Agencies also could consolidate or upgrade telecommunications channels to reduce total costs.

Room-Scale Videoconferencing

Room-scale videoconferencing favors sites where there are many people or many different agencies or functions, as opposed to a small office with a single function. For example, a conferencing room could be used for military reserve training on weekends, distance education for local citizens during weekday evenings, and employee training or meetings during working hours. Public health clinics could use it for telemedicine, or law enforcement officers for remote arraignment procedures. Congress has used videoconferencing in some pilot hearings and town hall meetings.[21,22,23] The conferencing industry is growing at the rate of several thousand new installations per year; some corporations have dozens of sites. At the end of 1991, over 5,000 videoconferencing rooms were in active use in North America.

Videoconferencing saves direct travel expenses, improves productivity, and eliminates traveling time. Travel is often still important, however, to truly understand another's environment and to get out of one's own. Videoconferencing also requires new communication skills and has some drawbacks. For example, automatic camera operation can be distracting for the viewer, hearing can be difficult, first-time participants are often uncomfortable, and groups can appear disorganized.

Desktop Conferencing and Interactive Multimedia

Desktop conferencing is the less expensive personal computing version of text- and videoconferencing limited to two or three people at a time—more or less "one-to-one." More important and less expensive than the video are its text- and audio-conferencing features. That is, two people in different offices can work on the same text or graphics simultaneously using computers linked together through local area networks (LANs). Store-and-forward technology may even one day allow people to exchange videoconferences and text files like electronic mail. Similar to electronic kiosks but more flexible, desktop videoconferencing is part of "interactive multimedia"[24]—the integration of sound, text, compressed video, and graphics in one terminal, using inputs from the user. This technology is advancing quickly, and is only limited by the development of standards and new applications.

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[19] The city noted that voter registration rates were almost four times higher after the field office was opened. See Eben Shapiro, "Even City Hall Has Moved to the Mall," *New York Times*, July 30, 1992, p. D1.

[20] See "Administration as Service: The Public as Client," *OECD Observer*, June 1987, p. 10, and other studies by the Organization of Economic Cooperation and Development (OECD).

[21] The U.S. House of Representatives has equipped six hearing rooms with cable for videoconferencing, and has conducted several hearings using videoconferencing. Its real value may be to receive more testimony from individuals "outside the Beltway." U.S. Congress, House Committee on Science, Space, and Technology, "Video Teleconferencing, A Congressional Demonstration Project," forthcoming. Also see Fred B. Wood, Vary T. Coates, Robert L. Chartrand, and Richard F. Ericson, "Videoconferencing Via Satellite: Opening Congress to the People," the George Washington University Program of Policy Studies in Science and Technology, April 1979.

[22] Agencies share information and promote standardization of equipment through the Video Conferencing Working Group under the Interagency Information Resources Management Infrastructure Task Group.

[23] The General Accounting Office found, in a 6-month pilot test, that videoconferencing was very effective, and saved $31,000 in travel expenses alone by eliminating 39 trips between Seattle, WA and Washington, DC. See U.S. Congress, General Accounting Office, *Video Teleconferencing—GAO's Pilot Test*, GAO/OIMC-92-1 (Gaithersburg, MD: U.S. General Accounting Office, December 1991).

[24] See the March 1993 issue of *IEEE Spectrum* and the May 1992 issue of *IEEE Communications Magazine* for a discussion of multimedia.

Doctors already use such multimedia workstations with large high-definition monitors to diagnose patients in distant hospitals or to receive medical records. Employees and citizens could use multimedia desktop conferencing for distance education and training, or for viewing library documents.[25] Government employees could use conferencing for small meetings between regional offices instead of traveling, telephoning, or using electronic mail. In the future, government and other telecommuters could use desktop conferencing to create a "virtual office" at home; that is, they can contact co-workers and work together as if they were in the same office.

Agencies could use desktop conferencing to form a "virtual one-stop service center" if they cannot physically colocate. That is, when a citizen visits one office, the agency representative could contact other Federal, State, or local workers through a desktop conference to consult or save the person a trip. A telephone conference call could also be used, but the desktop conference would be more personal and engaging because the participants actually see one another. In addition, text or forms can be exchanged electronically, as can be done using the U.S. Public Health Service's "Community Services Network" pilot project.

Coordination and Logistics

The primary inhibitor of the one-stop service center is the cooperation it requires among traditionally competing agencies; it is a striking example of the importance of Federal-State-local partnerships. A one-stop center requires careful planning, teamwork, cross-training, and joint management.[26] Planners must assess the needs of the particular community. One-stop shopping will not always work for many rural Americans, non-English speakers, the homeless, illiterate Americans, children in need, and so forth because they are unaware of the services provided, disenfranchised, too remote, or too busy to participate.[27]

Another inhibitor is simply logistics. Centralized office space is a good idea, but often is not available or affordable. Long-term leases expire at irregular intervals; moving costs can be high. While many citizens may find the new service center simpler and more convenient, others may have to travel further for a particular service. As an intermediate step, agencies could send representatives periodically or full-time to a central point to help the public and work with other agencies, or create the "virtual one-stop centers" described above.

Mobile Access

A number of technologies could provide mobile access to government services (see table 2-5). For example, Federal workers could be contacted by telephone or computer while out of the office; satellites could deliver distance education to agency staff; and new mobile computer technology could allow workers to process forms and retrieve data without returning to the office. Mobile services are used by emergency and law enforcement officials, but also might be beneficial to human services caseworkers.

A new mobile application might involve a "Service Center on Wheels" or "Mobile One-Stop Service Center" that combines many functions in a truck or van and uses satellite or land-based receiving equipment. Such a mobile service center might include portable or laptop computers with CD-ROM drives, or wireless modem or ISDN communications. Portable electronic kiosks could be installed quickly in emergency situations. The one-stop service center, in partnership with State and local governments, might manage such mobile services.

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[25] The Library of Congress in Washington, DC, has a National Demonstration Laboratory that showcases such new technologies. Included is the American Memory Project for electronically disseminating all types of media—first in CD-ROM and laser disks, and later on-line.

[26] For example, see Marilee C. Rist, "One-Stop Shopping for Student Social Services," *The Education Digest*, vol. 58, No. 1, September 1992, p. 12.

[27] Gordon Landes, "A State View of One-Stop Shopping," *Public Welfare*, vol. 50, No. 1, winter 1992, p. 35.

Table 2-5—Mobile Service Delivery Technologies: Key Characteristics and Selected Applications

Technology	Key characteristics	Selected applications
Cellular telephony and data	Operates in 1- to 50-mile diameter "cells"; currently analog but converting to digital; limited to areas that have transmitters	Case- and field-workers, mobile service centers
Personal communication services (PCSs)	In trial stage; include technologies using microcells and personal communication networks (PCNs)	Office buildings, hospitals, etc., where user density is large
Portable computers, laptops, electronic notebooks	Allow office to be mobile; new features include modems and CD-ROM readers; some have limited pen-based input; "personal communicators" promise to combine computing with wireless telephone, fax, and data'	Case- and field-workers, mobile service centers
Portable electronic kiosks	Could be deployed in distressed areas to provide information or process applications for services	Emergency services
Transportable earth stations, very small aperture terminals (VSAT)	Satellite dishes for all types of telecommunications (voice, data, and video) in remote or mobile locations where cables or land-based antennas are not effective; very useful for broadcast	Emergency services, mobile service center, distance education, videoconferencing
LEO satellite service	Proposes national or global data and telephone coverage beyond range of terrestrial systems; under development	Case- and field-workers, emergency services, GPS services
GPS receivers	New compact receivers allow placement in small aircraft, boats, cars, and trains; over 1 million commercial users estimated by the year 2000	Navigation, positioning, traffic control

KEY: GPS=Global Positioning Satellite; LEO=Low Earth Orbit

SOURCE: Office of Technology Assessment, 1993.

The major strength of mobile service delivery is its outreach capability. A service center on wheels can help those isolated by distance, disabilities, language, education, illness, age, economic level, the need to care for others, or other limitations. As with the fixed service centers, the most important mobile service is a human one, and the technology only helps the worker to perform tasks and extend the office to the field.

Mobile communication[28] includes radio telephones, pagers, cordless telephones for the home, CB radios, private dispatch networks, cellular telephones, air-to-ground telephone services, one-way and two-way satellite services, and the proposed personal communication services (PCS).[29] The Federal Government obtains its mobile communications through both the National Telecommunications and Information Administration's (NTIA's) allocations (air traffic control, law enforcement, maritime, military, etc.) and through the Federal Communication Commission's (FCC's) allocations to private enterprise.[30] An agency can purchase commercial cellular telephone service in the same way it purchases a fixed telephone line for an office—directly from commercial vendors.

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[28] For a study of spectrum allocations, including mobile communications, see U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Issues for U.S. International Spectrum Policy*, OTA-BP-TCT-76 (Washington, DC: U.S. Government Printing Office, November 1991). See also U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Technology and Policy Implications*, OTA-TCT-549 (Washington, DC: U.S. Government Printing Office, May 1993).

[29] The family of personal mobile communications is sometimes called Personal Communication Services (PCS), but PCS also refers to a specific frequency allocation for certain new and evolving technologies, including what is sometimes referred to as Personal Communications Networks (PCNs). PCNs would use microcells and digital signaling. The combination of mobile communications, fixed telephones, and intelligent networks suggests a proposed service that assigns an identifier to each user, rather than to each piece of equipment. In principle, one

The wider use of cellular telephones for delivering government services is inhibited by uneven and expensive access. Over 90 percent of the U.S. population can access cellular service, but only 60 percent of the land area, excluding Alaska, is covered.[31] Many small rural markets with the greatest need for mobile service delivery cannot access cellular service. The proposed low earth orbit (LEO) satellites promise to supplement these holes in land-based cellular service by directly transmitting to and receiving from small handsets. The proposed systems would be very expensive to build, however, and would have to compete with existing cellular systems or generate profits in regions currently considered unprofitable for land-based cellular telephony.[32]

Stores and Banks—Electronic Benefits Transfer (EBT)

What Is EBT?

Electronic benefits transfer (EBT) is defined here as monetary (or in-kind) government benefits delivered electronically directly to the citizen, or on behalf of the citizen, through the use of an electronic funds transfer network, point-of-sale (POS) technology, and automated teller machines (ATMs). EBT includes electronic funds transfer (EFT) between banks for direct deposit of Social Security checks. Direct deposit is the least expensive form of benefits transfer,[33] but many recipients do not have bank accounts. EBT also includes cards, similar to bank money cards, which can be used to debit government benefits accounts and therefore can be used to replace paper checks or food stamp coupons. The benefits and costs of EBT are discussed more fully in chapter 4.

The use of cards to deliver benefits reduces human errors, paperwork, and delays. Recipients are identified through the use of passwords and transactions are encrypted, reducing fraud and counterfeiting. Portable and secure off-line cards can also reduce the need for large central on-line databases, such as those containing medical records or benefits.[34] Perhaps most important, serv-

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would call a unique number to locate someone, and the network would automatically track the person. This proposed integration is known as Universal Personal Telecommunications (UPT), or the personal numbering system. For a review of global and national activity in PCN and PCS, see Bennett A. Kobb, "Personal Wireless," *IEEE Spectrum*, June 1993, and the June and December 1992 issues of *IEEE Communications Magazine*. See also George Brody and Jack Wasserman, "Evolving Voice Technologies for PCS," *Business Communications Review*, April 1992, p. 34.

[30] The Cellular Radio Working Group of the Interagency Information Resource Management Infrastructure Task Group acts to share information and evaluate government needs for member agencies.

[31] U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Technology and Policy Implications*, op. cit., footnote 28, p. 125.

[32] Since cellular telephone conversations sometimes can be overheard by other users, the government's use of commercial cellular telephones requires added security. See Booz-Allen & Hamilton, Inc., "The Implications of Digital Cellular Communications for NS/EP [National Security and Emergency Preparedness] Telecommunications," contractor report prepared for the Office of the Manager, National Communications System, May 14, 1992.

[33] For example, Fresno County, CA, reported direct costs of 12 cents per transaction versus 49 cents per check. Fifty-four percent of social security recipients currently receive benefits by direct deposit. See John Harris, Alan F. Westin, and Anne L. Finger, Reference Point Foundation, "Innovations for Federal Service," contractor report prepared for the Office of Technology Assessment, February 1993.

[34] A health care card might have several applications—it might directly pay for certain services, such as prescription drugs; it might act as a common front-end to many incompatible systems to improve processing, but without completely eliminating paper or on-line verification; or it might contain medical information immediately accessible in case of emergency or as a check against errors when prescribing medications. A primary issue regarding health care applications concerns the privacy of centralized medical records. See U.S. Congress, Office of Technology Assessment, *Privacy Rights in Computerized Medical Information*, forthcoming. See also U.S. Congress, Office of Technology Assessment, *Electronic Record Systems and Individual Privacy*, OTA-CIT-296 (Washington, DC: U.S. Government Printing Office, June 1986).

ice recipients like benefit cards because they eliminate the stigma associated with food stamp coupons or public assistance checks, and they save time.

Types of EBT Cards

Table 2-6 displays basic characteristics of the card technologies; hybrid cards that combine the characteristics of magnetic stripe cards and either integrated circuit or optical cards are also possible.[35,36] In this report, *microprocessor/smart cards* (or simply *smart cards*) are those using integrated circuits with microprocessing capability and some memory. A smart card has an actual computer chip embedded in it, allowing the card itself to make independent calculations. It is literally a portable computer, but the POS terminal provides the power supply, keyboard, and display. Even if an unauthorized user could read the data in the smart-card memory, the data are encrypted and the computer chip itself is virtually impossible to duplicate.

The smart card can be designed so that only the issuer can access some data in its memory (for recordkeeping), only the user for other data (ac-

Table 2-6—Types of Card Technologies: Key Characteristics and Selected Applications

Card type	Key characteristics	Selected applications
Magnetic stripe	Inexpensive ($0.20 to $1 per card); ubiquitous terminals—good for on-line systems; some are rewritable; small data storage (1 to 7 kbits); easily copied or altered	On-line: bank cards, credit cards, CA driver's license, AR's Medicare card, several food stamp pilots. Off-line: subway farecards
Memory-only (integrated circuit)	Functions like magnetic stripe card but has more memory (100 bits to 64 kbits), is more expensive ($1 to $6 per card), and is more difficult to copy; some are rewritable	Off-line: telephone debit cards; Arlington County, VA's "Parkulator" parking card
Smart (integrated circuit)	Includes computing and encryption—good for off-line systems; more storage than magnetic stripe card (2 to 8 kbits); is more expensive ($5 to $25 per card); more difficult to copy; rewritable	Off-line: WY's WyoCard for WIC benefits; Montgomery County, OH's food stamp card
Optical	Large data storage (30 Mbits); not rewritable; $5 to $20 per card, but readers are expensive ($1,500 to $4,000 apiece) and require precise and frequent calibration; uses technology similar to CD-ROMs	Reference materials in portable computers, medical records, biometrics
PCMCIA Memory (integrated circuit with connector)	Not practical for EBT; large data storage (20 to 40 Mbits); rewritable; $100 to $650 per card	Backup, add-ons for personal computers

Hybrid cards that combine magnetic stripes with integrated circuit or optical cards are also possible.

KEY: AR=Arkansas; CA=California; CD-ROM=compact disc, read-only memory; EBT=electronic benefits transfer; kbits=kilobits; Mbits= megabits; OH=Ohio; PCMCIA=Personal Computer Memory Card Industry Association; VA=Virginia; WIC=Special Supplemental Food Program for Women, Infants, and Children; WY=Wyoming.

SOURCE: Office of Technology Assessment, 1993.

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[35] For more information on card technologies and their applications, see Jerome Svigals, *Smart Cards: The New Bank Cards* (New York, NY: Macmillan, 1987).

[36] EBT is promoted within the Federal Government by the Interagency EBT Steering Committee, co-chaired by the Department of the Treasury and the Department of Agriculture. The Smart Card Users Group is a larger group for sharing information about all types of card technologies.

count balances), only store personnel for other information (transaction data), and perhaps only fourth parties for yet other information (e.g., allergies or drug prescriptions).

The physical layout and many other features of the smart card are standardized. The operating systems and application programs currently are not standardized, but could be soon (or the POS terminals could be designed to read different systems). Then only the smart cards themselves would need to be upgraded whenever new services are added to an existing card.

An *integrated circuit (IC) memory card* (or simply *memory-only card*[37]) has an integrated-circuit chip with more or less memory than a smart card, but without microprocessor capability. This card operates in an on-line system similar to a magnetic stripe card, but it looks exactly like a smart card (and is sometimes called a smart card by vendors). It does not offer the security features of the smart card, nor the low cost or the ubiquitous readers associated with the magnetic stripe card.

The familiar *magnetic stripe cards* used in ATMs and POS terminals are standardized, although more advanced proprietary versions also exist. The terminals are becoming widely available in stores where citizens use their government benefits. Magnetic stripe cards require a password; the stored data are not encrypted, however, and the card is easily duplicated with inexpensive ($50) parts, making it less secure.

Implementation Issues

Besides the different cards, there are also different configurations of EBT systems—fully off-line, polled off-line, on-line to a central computer, selective on-line, on-line to many diverse systems (a common front-end), or selective on-line (see table 2-7). All the cards can function in any of these configurations, but each card has certain strengths and weaknesses depending on the application. The common front-end approach allows an intermediate solution in applications where there are many noninteroperable systems, such as in the health care industry.

Other EBT issues concern overall implementation, rather than selection of a specific card or system (see ch. 4). For example, paper food stamp coupons are costly for States to distribute, stores and banks to handle, and for recipients who must go to the government office and wait in line. EBT may shift more of the relative cost from recipients, stores, and banks to the Federal and State Governments, which in turn affects the overall cost determination. Some of this cost could be shared among these partners, or an EBT system might "piggyback" with the existing banking network of ATMs and POS terminals.

Electronic Commerce and Electronic Data Interchange (EDI)

What Is Electronic Commerce and EDI?

Both electronic commerce and electronic benefits transfer remove the paper from transactions.[38] The difference is that electronic commerce applies to government trade with businesses—perhaps health care providers, contractors, or regulators—whereas EBT applies to monetary public assistance transactions provided to citizens using cards, POS terminals, or ATMs. Electronic commerce and EBT may overlap in many cases; for example, if they are used for both recipients and health care providers in the Medicare program. Electronic commerce may also overlap with other points of access, particularly homes and offices. Table 2-8 shows the components of electronic commerce and their characteristics.

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[37] These memory cards should not be confused with PCMCIA memory cards used as add-on hardware or memory backup for personal computers. Such cards correspond to standards devised by the Personal Computer Memory Card Industry Association (PCMCIA) and are not appropriate for EBT.

[38] See Benjamin Wright, *The Law of Electronic Commerce: EDI, Fax, and E-mail* (Boston, MA: Little, Brown and Co., 1991), and Benjamin Wright, "Contracts Without Paper," *Technology Review*, vol. 95, No. 5, July 1992, p. 57. See also Eric Arnum, "New Specs, Broader Boundaries for EDI," *Business Communications Review*, February 1993, p. 40; and Michael S. Baum and Henry H. Perritt, Jr., *Electronic Contracting, Publishing, and EDI Law* (New York, NY: Wiley Law Publications, 1991).

Table 2-7—Types of EBT System Configurations: Key Characteristics and Selected Applications

Configuration	Key characteristics	Selected applications
Full off-line	No connections to other computers; no communication or transaction costs	Subway farecards and hotel keys (magnetic stripe), telephone debit cards (memory-only card), biometrics (optical card)
Off-line—polled	Off-line, but terminal collects transactions for later transmission to central computer; no verification delays; low transmission and transaction costs	Wyoming's WyoCard for WIC benefits (smart card); Dayton, Ohio's food stamps (smart card)
On-line—central computer	Decisions made at a central computer; requires continuous or dial-up connection to verify passwords and complete transactions; changes can be up to the minute; favors inexpensive magnetic stripe cards since memory or secure storage is not a factor	Bank cards, Maryland's benefits card, Arkansas' Medicare card
On-line—selective	Routine decisions made off-line, but some decisions made on-line	French bank cards
On-line—independent computers	The "common front end": allows many diverse systems to read one simplified card to avoid overhauling many systems; added security since there is no central computer or interoperability between systems	Health care providers, interagency or interprogram card—the card used depends on memory, cost, and security needed

Any of the cards can be used in any of the configurations, but some applications favor certain cards.

SOURCE: Office of Technology Assessment, 1993.

EDI refers to the electronic transfer of business information in a standardized electronic form between parties. EDI includes a body of standards and applies to *nonmonetary* transactions. The transfer can involve trading personal computer diskettes by mail, dial-up of a central computer by modem, or direct personal or mainframe computer-to-computer links. EDI is not simply a way of transmitting a paper document via computer. Documents are customized to take advantage of the strengths of the computer and might never be seen by human eyes, although electronic mail or facsimile is often used in lieu of fully computerized transactions.

EDI Costs and Savings

The main strengths of electronic commerce and EDI are improved management and service, and reduced costs and errors for data entry, mailing, and handling and storage of paper. Agencies and vendors can streamline and standardize forms and improve inventory control. Electronic commerce includes "just-in-time" delivery; computers may approve bids and make orders, bills, and payments, all automatically. Cost savings add up; in 1990, EFT cost 4.5 cents per transaction, versus 30.2 cents per paper check.[39] Direct Federal payments of 360 million benefits in 1989 using EFT saved $94 million. The Department of Housing and Urban Development expects to save up to $12 million annually using EDI to process $4.7 billion in mortgage claims.[40] The U.S. Customs Service uses electronic declarations for 92 percent of all declarations, 29 percent of which are totally paperless. Forty percent of its $20 billion annual collections are electronic, saving over $500 million annually in transaction and person-

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[39] Office of Management and Budget, *A Five-Year Plan for Meeting the Automatic Data Processing and Telecommunications Needs of the Federal Government*, (Washington, DC: U.S. Government Printing Office, November 1990), p. II-21.

[40] John Moore, "HUD Plans EDI Pilot To Process Mortgages," *Federal Computer Week*, Aug. 24, 1992, p. 1.

Table 2-8—Electronic Commerce Technologies: Key Characteristics and Selected Applications

Technology	Key characteristics	Selected applications
Electronic data interchange (EDI)	Nonmonetary electronic document transfers using the X12 or UN/EDIFACT standards; some wider definitions include nonstandard or proprietary formats, monetary transactions, or text-based systems such as electronic mail or fax	Invoices, delivery reports, tariff filings, customs declarations, tax forms, insurance claims
Electronic funds transfer (EFT)	Monetary electronic transactions using standards developed in the banking industry	Direct deposits, interbank transfers, ATM transactions
Electronic mail and other ASCII text-based systems	E-mail can transport EDI documents, and internal and business correspondence; text-based systems in general are not designed for computer processing	SEC's EDGAR system
Computer-aided acquisition and logistics systems (CALS)	Similar to EDI, but used for engineering information that uses computer-aided design	Technical drawings, manuals, engineering data
Universal product codes (bar codes)	Reduce keystrokes and errors; new "portable data files" store 100 times the bar-code information in a two-dimensional block of dots	Inventory control, delivery documents
Imaging	Digitizes paper documents; advanced imagers can interpret typewritten and sometimes handwritten messages; relatively expensive	Conversion of mail, fax documents, tax forms, and letters
Electronic archiving	Includes storage of all documents in electronic form	All documents and messages
Facsimile (fax)	Does not eliminate paper, but is widely used; high-speed fax requires digital telephone service	Same as for EDI

Some of these technologies overlap; for example, imaging can be used to store fax documents in electronic archives.

KEY: ATM=Automated Teller Machine; EDGAR=Electronic Data Gathering, Analysis, and Retrieval; SEC=Securities and Exchange Commission.

SOURCE: Office of Technology Assessment, 1993.

nel costs.[41] The Environmental Protection Agency expects to speed up the processing of hazardous waste reports and save $10 million to $15 million per year, with a setup cost of $1 million and operating costs of $5 million to $10 million per year.[42] Widespread use of EDI in the health care industry may save several billion dollars annually in annual health insurance administration costs.[43]

EDI is most useful for repetitive and standard transactions; the government will benefit by larger penetration of EDI into its daily business.[44] In practice, EDI is often just another interface to existing systems—the government (or a large corporation) moves the manual-electronic interface to the businesses with whom it trades. This added interface can be a particular burden for the operators of many small businesses. To help ease this burden, the government could use some of its savings from the use of EDI to subsidize businesses that have no obvious economic incentives to participate in EDI. Businesses also could be encouraged through software discounts, toll-free lines, or special training and assistance.

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[41] Robert W. Ehlinger, "U.S. Customs Service and EDI," *EDI World*, vol. 2, No. 8, August 1992, p. 27.

[42] Shawn P. McCarthy, "EDI Speeds Up Transfer of Environmental Data," *Government Computer News*, Feb. 1, 1993, p. 54.

[43] Workgroup for Electronic Data Interchange (WEDI), report to the Secretary of the U.S. Department of Health and Human Services, July 1992. Another study cosponsored by telephone industry companies found that electronic claims-processing alone could save $6 billion in the health care industry. Mark K. Schneider, Nancy Mann, and Arthur Schiller, Arthur D. Little, "Can Telecommunications Help Solve America's Health Care Problems?" July 1992.

[44] Over 200,000 government contractors and vendors make 21 million transactions annually that are eligible for EDI. Of these, nearly all (over 98 percent) are for amounts less than $25,000.

EDI Integrity and Security

Due to the sensitive nature of business documents, parties sometimes must make agreements in advance regarding the legal validity of electronic documents, what constitutes a "written signature," the length of time required to store documents, and other details traditionally contained in the "fine print."[45] The Office of Management and Budget (OMB) claims that, for government operations, an electronic signature or password is an acceptable substitute for a written signature, provided agencies follow proper administrative procedures.[46-47]

Risk assessment needs to be given a higher priority in EDI systems.[48] The Computer Security Act encourages Federal agencies to conduct risk assessments to help assure that the security is commensurate with the potential harm resulting from the loss, misuse, modification, or unauthorized access to government information.[49] Based on content, documents such as questionnaires may carry a low risk, whereas high-value purchase orders, bids, and tax returns carry a greater risk. Agencies or Federal budget managers too often under-budget for risk assessment, placing electronic documents at risk through loss or leaks of private or proprietary information.

EDI Standards and Telecommunications

The Federal Government has mandated the use of X12 and UN/EDIFACT standards[50] whenever possible for all EDI transactions, or conversion to them in the near future.[51] Despite some momentum to use these standards, the government uses many proprietary or text-based systems that often require government suppliers or contractors to purchase proprietary software and equipment and use private communication networks. With standard EDI formats, however, suppliers can use the same open systems for other government and nongovernment transactions, to everyone's benefit.

Most EDI transactions require a communications link through a leased or dial-up telephone line or a value-added packet-switching network. The Federal Government's private long-distance services program (FTS2000) can support some EDI transmission through electronic mail or dial-up and leased lines, but it does not provide full value-added services (see ch. 3).[52] Value-added carriers can store and forward messages to other participants, and provide audit trails, postmarking, archiving, retransmission, compliance checking, and other services. Value-added network services are currently procured as a separate contract through the General Services Administration (GSA).

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[45] See, for example, U.S. Department of Justice, Justice Management Division, "Admissibility of Electronically Filed Federal Records as Evidence," *Government Information Quarterly*, vol. 9, No. 2, 1992, p. 155; or Office of Management and Budget, *Information Resources Management Plan of the U.S. Government* (Washington, DC: U.S. Government Printing Office, December 1991), p. 36.

[46] See, for example, Peter Weiss, "Security Requirements and Evidentiary Issues in the Interchange of Electronic Documents: Steps Toward Developing a Security Policy," paper presented at the Workshop on Security Procedures for the Interchange of Electronic Documents, National Institute of Standards and Technology, Gaithersburg, MD, Nov. 12–13, 1992.

[47] OMB also chairs the Electronic Signature and Messaging Authentication Task Force on electronic signature issues.

[48] Julie A. Smith, Logistics Management Institute, "Risk Assessment and Electronic Data Interchange"; and Robert V. Jacobson, "The Need for Risk Analysis"; papers presented at the Workshop on Security Procedures for the Interchange of Electronic Documents, National Institute of Standards and Technology, Gaithersburg, MD, Nov. 12–13, 1992.

[49] U.S. Department of Commerce, National Institute of Standards and Technology (NIST), Computer Systems Laboratory Bulletin, "Security Issues in the Use of Electronic Data Interchange," June 1991. See also Computer Security Act of 1987, Public Law 100-235, 40 USC 759.

[50] X12 is a standards committee accredited by the American National Standards Institute (ANSI). UN/EDIFACT is the United Nations EDI for Administration, Commerce, and Transport standard. The X12 standards committee voted that further development of X12 standards will discontinue in 1997, and new standards will support the international UN/EDIFACT formats.

[51] Federal Information Processing Standard Publication 161, Electronic Data Interchange, *56 Federal Register* 13123 (Mar. 29, 1991).

NEED FOR AN ELECTRONIC DELIVERY TECHNOLOGY STRATEGY

OTA found, from its review of the electronic delivery technologies discussed above, that the technologies themselves generally do not limit service delivery. At this time, however, the Federal Government lacks an interagency or national strategy to implement electronic delivery technologies, and needs to develop one to leverage its efforts and to assure that important issues, such as access and privacy, are addressed. Federal, State, and local governments are applying many of these technologies but are doing so independently, and missing opportunities as a result. Congress and the President could oversee the development of a governmentwide technology strategy for electronic service delivery, with active participation by NIST, GSA, NTIA, and agency representatives, perhaps working through an interagency committee. Such a strategy could be part of the larger service delivery strategy discussed in chapters 1, 5, 6, and 7, and more comprehensive than current Information Resource Management (IRM) or standards-setting efforts.

A technology strategy as discussed here should not be interpreted to mean an overall central plan for all electronic delivery, and is not intended to focus only on the technologies *per se*. It should instead be a framework that allows innovation and partnerships both within and outside government, avoids "reinventing the wheel," and properly applies the technologies to citizen needs. The strategy could include ongoing workshops, conferences, and publications to provide a clearinghouse for Federal agencies and State and local governments to share information and keep up with technology. Users' groups are particularly important to enable agencies to share their experiences.

Leadership

An effective technology strategy would encourage leadership at all levels. In the cases OTA studied, effective leadership was critical to every project—even low-cost and user-friendly technology and the hard work of many dedicated parties were not enough. Leadership includes having a clear vision and commitment; supporting innovation; taking risks where appropriate; understanding citizens' needs; outlining a clear mission and objectives; and fostering teamwork with different agencies, governments, industry, and citizens. Strong, effective leadership helps to overcome inertia to change and encourages innovation at all levels.

Pilot Tests

An effective technology strategy would emphasize pilot tests and partnerships. Pilot projects allow agencies and local governments to innovate, experiment, gain experience, and then apply the appropriate technology. Such experimentation produces more diversity and presents a smaller risk than selecting a single "winning" technology. Systems that work well in one situation may not work in another or may not scale to the Federal level or across agency boundaries. The technologies and standards are also moving and risky targets, and the demand for electronic services is not well known.

Open Systems

An effective government technology strategy would seek to use open systems as the common delivery platform through consensus or by encouraging industry to develop standards. Open systems are those that use commercially available equipment and software that conform to common interoperable standards, as opposed to proprietary or custom-built systems. Open systems are like open markets; new players can innovate and sell their products, and buyers can use them in existing systems. The common standard could be a de facto standard derived from market preferences or a de jure standard established by a standards committee, although changing and competing standards often make open systems difficult to achieve in practice. If State and local kiosks used common operating systems, the Federal Government could provide standard packages to State and local governments, saving money for all. If the government uses compatible videoconferencing equipment, different agencies could share equipment. Agencies also could share information using common electronic bulletin boards, CD-ROMs, or the Internet instead of creating redundant systems. Future smart cards may also have open operating systems so that developers can sell new applications that operate on the same card, even if the microprocessor is upgraded.

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[52] X.400 electronic mail is used for some EDI transactions over FTS2000. X.435 will eventually replace X.400 for that purpose and will help to standardize some EDI transactions inside the government, but will not provide full value-added services.

Emphasize the User

An effective technology strategy should also emphasize the human element—the citizen—that is present in every aspect of service delivery. Success is defined by how well a new delivery system meets the needs of users, not by how well the technology functions or meets cost projections. Food stamp recipients like using benefit cards because they remove the stigma of paper coupons. Welfare applicants like the Tulare Touch electronic kiosk because it treats them consistently and without bias. Teachers in rural schools like computer networks because they can collaborate with other teachers and overcome their isolation. The one-stop service center and mobile services address citizens' needs directly.

People using computer networks at home could benefit from government on-line assistants who answer questions by electronic mail. These assistants could help the citizen find an agency or another on-line service. In this way, on-line services would be friendly to all citizens, not only those who are already computer literate.

User-friendly interfaces are critical to the success of electronic service delivery. Citizens will compare new ways of delivering government services with current commercial services using state-of-the-art interfaces. Therefore, government electronic services must be user-friendly, up to date, and high in quality to assure success. Active "information filters" will be necessary to help the user manage the massive amounts of information appearing on the Internet and other computer networks.

Agencies should develop directories or participate in governmentwide directories or gateways, such as FedWorld, that facilitate citizen access. An electronic kiosk presentation must anticipate a diverse set of queries and be kept up to date, since the kiosk allows the user to respond only to what is already in the computer. The information on electronic bulletin boards or other on-line services also must be kept current. Even the telephone voice response system, one of the easiest systems to use, can frustrate users if they receive too many recordings, lines are busy, or they are put on "hold."

Another important aspect of the "human factor" is protecting the privacy and security of personal information (see also ch. 7). Unless adequate precautions are taken, citizens could perceive that new electronic services will be used to store data that could later be used to exclude them from medical benefits or jobs. Business transactions, tax refunds, and public assistance benefits are all subject to abuse. On the other hand, the technology—if properly implemented—can provide more privacy protection. Security can actually be improved through the use of technologies such as encryption, passwords, caller identification, and use of tokens such as smart cards or biometric identifiers.[53]

User Cost and Access

An effective technology strategy should also address the recipient's costs for electronic delivery, which directly affect access. On-line services, facsimile, CD-ROMs and other home services require equipment that many people currently do not have. Telephone-based services typically require touchtone telephones, which some citizens do not have. Many automated telephone response systems have not been upgraded to be TDD-compatible for the hearing- or speech-impaired. A small percentage of citizens—some of the Nation's neediest—still do not have basic telephone service. EDI costs can be a barrier for small businesses. Internet-based services require access to an Internet provider, which may be expensive in some areas. Many costs may be acceptable for businesses, but may deny access for individuals. (Access issues related to the telecommunications infrastructure are discussed in ch. 3; also see chs. 5, 6, and 7.)

Provider Cost

Government agencies have implemented many electronic delivery technologies with limited budgets. In many cases, the technologies can save the government money and recover the cost of implementation. Benefits often are difficult to estimate, however, and should be calculated over the life of the program. Service delivery includes intangibles that are hard to quantify. How valuable is a new toll-free service for Americans confined to the home? What is the value of a complicated expert system that improves the quality of information on preventive medicine? Improving the quality of services may also increase demand, thus increasing overall costs. The technology strategy could examine these and related questions from a governmentwide and long-term perspective, rather than from an individual program viewpoint.

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[53] See U.S. Congress, Office of Technology Assessment, *Privacy Rights in Computerized Medical Information*, forthcoming. See also U.S. Congress, Office of Technology Assessment, *Electronic Record Systems and Individual Privacy*, OTA-CIT-296 (Washington, DC: U.S. Government Printing Office, June 1986)), and Defending Secrets, Sharing Data, OTA-CIT-310 (Washington, DC: U.S. Government Printing Office, October 1987).

Telecommunications Infrastructure for Electronic Delivery

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SUMMARY

The telecommunications infrastructure is vitally important to electronic delivery of Federal services because most of these services must, at some point, traverse the infrastructure. This infrastructure includes, among other components, the Federal Government's long-distance telecommunications program (known as FTS2000 and operated under contract with commercial vendors), and computer networks such as the Internet. The telecommunications infrastructure can facilitate or inhibit many opportunities in electronic service delivery. The role of the telecommunications infrastructure in electronic service delivery has not been defined, however. OTA identified four areas that warrant attention in clarifying the role of telecommunications.

FRED B. WOOD

First, Congress and the administration could review and update the mission of FTS2000 and its follow-on contract in the context of electronic service delivery. The overall performance of FTS2000 shows significant improvement over the previous system, at least for basic telephone service. FTS2000 warrants continual review and monitoring, however, to assure that it is the best program to manage Federal telecommunications into the next century when electronic delivery of Federal services likely will be commonplace. Further studies and experiments are needed to properly evaluate the benefits and costs of FTS2000 follow-on options from the perspective of different sized agencies (small to large), diverse Federal programs and recipients, and the government as a whole.

Planning for the follow-on contract to FTS2000 could consider new or revised contracting arrangements that were not feasible when FTS2000 was conceived. An "overlapping vendor" approach to contracting, as one example, may provide a "win-win" situation for all parties and eliminate future debates about mandatory use and service upgrades. The General Services Administration (GSA) could conduct or sponsor experiments with agencies and vendors to test alternative contracting arrangements. Such experiments could help demonstrate and evaluate the ability of FTS2000 follow-on options to meet agency and governmentwide needs, and help assure equitable, innovative, and cost-effective use of telecommunications for electronic delivery of Federal services.

Second, Congress could review its overall intent for the National Research and Education Network (NREN) program regarding electronic service delivery. Current congressional efforts to support Internet applications using NREN, for health care and education for example, serve to promote widespread electronic service delivery. The Federal Government does not have to wait to resolve all NREN issues before using computer networking for electronic delivery. The government could deliver many more electronic services through the Internet, as some agencies are already doing for a few services. Under any scenario, the Internet needs to be more user-friendly by providing on-line directories or "on-line librarians" to help users find the government information and services they need. Agency applications need to be creative and relevant, yet require little training, to assure broad use.

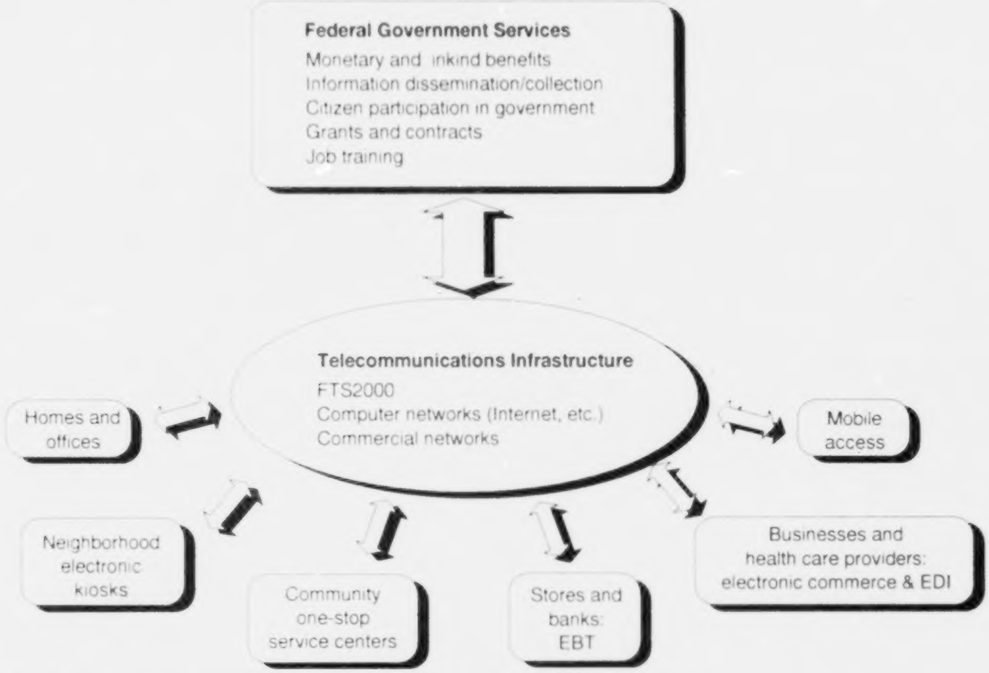
Third, Congress could review the commercial telecommunications infrastructure in light of electronic delivery. The "last mile" is particularly important for electronic delivery to the home; electronic information usually must traverse the lines of the local exchange carrier or other local provider at both ends, even for FTS2000 and Internet transmissions. This last mile can be a bottleneck for delivering affordable services in some areas of the United States, however. Access to Internet or other computer networking services can be expensive, and in many areas digital services needed for electronic service delivery are not available over the public switched network. The national infrastructure will be much stronger if users in all areas can electronically connect to compatible telecommunication systems in other areas of the Nation—the whole is greater than the sum of its parts. Congress could revise the concept of universal service to include nationwide affordable access to modern telecommunication services, such as the Internet, ISDN (Integrated Services Digital Network), and emerging broadband (high-transmission-rate) services. Vendors are testing fiber optics, coaxial cables, very-small-aperture satellite receivers, and digital mobile services for electronic delivery as alternatives to the copper wire pairs that still dominate the last mile.

Fourth, Congress could encourage Federal agencies not to wait for widespread implementation of fiber and broadband technologies to improve government services through electronic delivery. Many electronic services—Federal or otherwise—can be delivered affordably with the copper wires that deliver traditional telephone service; for example, using modems or ISDN services. ISDN in particular offers a significant improvement in the rate at which a user can send or receive data, and it can transport voice, data, or video messages. Switched broadband technologies, on the other hand, face many technical, standards-setting, financial, and regulatory issues that must be resolved before affordable nationwide access becomes a reality.

THE ROLE OF TELECOMMUNICATIONS IN ELECTRONIC DELIVERY: AN OVERVIEW

The six points of access in chapter 2 describe technologies that bring services directly to the recipient. These technologies frequently use telecommunications to deliver those services (see figure 3-1). This chapter discusses the role of the telecommunications infrastructure in electronic delivery, especially two components that are particularly important in delivering Federal services: 1) the Federal long-distance telecommunications program (known as FTS2000), and 2) the Internet and the evolving NREN program. These and other

Figure 3-1—Role of Telecommunications Infrastructure in Delivering Federal Services Via Six Points of Access


Federal Government Services
Monetary and inkind benefits
Information dissemination/collection
Citizen participation in government
Grants and contracts
Job training
Telecommunications Infrastructure
FTS2000
Computer networks (Internet, etc.)
Commercial networks
Homes and offices
Mobile access
Neighborhood electronic kiosks
Community one-stop service centers
Stores and banks: EBT
Businesses and health care providers: electronic commerce & EDI

NOTE: The Federal services and infrastructure components shown are illustrative, not comprehensive.

KEY: EBT=Electronic Benefits Transfer; EDI=Electronic Data Interchange; FTS2000=the Federal long-distance telecommunications program.

SOURCE: Office of Technology Assessment, 1993.

components of the infrastructure are also important economic catalysts, and enhance the long-term competitive position of the United States.[1]

The telecommunications industry is very different today from what it was when Congress enacted the Communications Act of 1934,[2] or even 10 years ago. The industry was once dominated by one telephone company (AT&T), but is now diversified with many different types of providers. Some providers are like wholesale stores, some like department stores, others like boutiques, and a single transmission often involves several vendors. Telecommunication services also have changed considerably due to advances in fiber optics, microelectronics, and software used for switching systems. Digital transmission is replacing analog even to the home and office. As a result, voice, text, and video all become simply data that computers can process and transmit more efficiently. Telephone, video, and computer transmissions become more alike—personal computers send data and video over telephone lines, and new telephones contain computer chips and video screens. The intelligence in the system also is becoming less centralized—the end-user has more direct control over functions.

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[1] See U.S. Congress, Office of Technology Assessment, *Critical Connections: Communication for the Future*, OTA-CIT-407 (Washington, DC: U.S. Government Printing Office, January 1990); U.S. Congress, Office of Technology Assessment, *U.S. Telecommunications Services and European Markets*, OTA-TCT-548 (Washington, DC: U.S. Government Printing Office, August 1993); and Institute for Information Studies, *A National Information Network—Changing Our Lives in the 21st Century* (Queenstown, MD: Aspen Institute, 1992). For a review of point-to-point two-way telecommunications in the United States, see U.S. Department of Commerce, National Telecommunications and Information Administration, *The NTIA Infrastructure Report: Telecommunications in the Age of Information*, NTIA Special Publication 91-26 (Washington, DC: NTIA, October 1991).

[2] Communications Act of 1934, 47 U.S.C. 151, *et seq.*

The commercial telecommunications industry has many strengths that can facilitate electronic service delivery. These include its diversity of vendors, new and specialized services, and lower prices. Services can be delivered over copper wire for telephones; coaxial cable for cable television; and airwaves for cellular telephony, radio, and television. This fragmentation also can be a weakness, however. Before its divestiture, for example, AT&T could efficiently adopt a single standard nationwide; today, it is more difficult to achieve a nationwide standard, and users lack experience dealing with diverse providers and new services. Boundaries between these different modes of delivery have led to technical and market inefficiencies. Cable companies, for example, have installed broadband (high capacity) services to the home via coaxial cable, but without switching. Telephone companies have full switching capabilities, but offer much less capacity to the home.

The commercial infrastructure generally can provide telecommunication services better than the government or a single corporation can do directly. Thus, the Federal Government generally purchases telecommunication services from commercial vendors, rather than purchasing equipment and leasing lines itself. Likewise, the government supports commercial or nonprofit networks for computer networking, rather than building or managing a network itself. The "information superhighways of the future" are, in large part, already constructed or being developed by commercial vendors. The Federal Government's role is that of customer, collaborator, and regulator, rather than that of direct provider.

Technology developments—such as packet switching—also enhance electronic delivery. With packet switching, data are collected into packets that in turn are sent one at a time as needed, rather than tying up transmission lines continuously. This allows the telephone and other network operators to squeeze transmissions together more efficiently. Packet-switching is currently used for automated teller machines, computer-to-computer messages, and electronic mail, all useful for electronic service delivery.

Other significant technology developments, such as high-speed modems and ISDN, allow homes to receive larger capacity digital services over existing copper telephone lines. These technologies could expand access to on-line Federal Government services to homes, offices, schools, and libraries at affordable prices. Broadband (high-transmission-rate) services could be delivered via fiber optic cable for telecommuting, interactive multimedia presentations, or telemedicine applications, for example. While this technology could deliver even more advanced Federal services to the home, many formidable issues remain to be resolved.

Cost-effective electronic delivery depends on systems being interoperable and compatible—thus the need for technical standards. The government could play a greater role in encouraging standards,[3] and standards should be given a higher profile in the community-at-large as well.[4] (See also ch. 7.)

Security is an ongoing concern with any large telecommunications network, especially for networks used to electronically deliver Federal services.[5] Absolute security is impossible, but various degrees of security can be obtained at corresponding costs. Many adequate security measures—such as encryption, complex passwords, and smart card keys—already exist and can be easily implemented.[6] However, individual users typically underestimate security needs, and additional oversight by network management is usually necessary.[7] (Ch. 7 discusses security and privacy issues in more detail.)

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[3] U.S. Congress, Office of Technology Assessment, *Global Standards: Building Blocks for the Future*, OTA-TCT-512 (Washington, DC: U.S. Government Printing Office, March 1992).

[4] Engineering and business schools generally do not teach standards-setting or its importance to business and production. Corporations and users alike lack a commitment to standards-setting. See Carl F. Cargill, *Information Technology Standardization: Theory, Process, and Organizations* (Bedford, MA: Digital Press, 1989).

PHOTOS: FRED B. WOOD

Top: Satellite, radio, and microwave communications center at the Denali National Park airport, Alaska.

Bottom: *Satellite earth station at the Salish Kootenai College on the Flathead Indian Reservation, Montana. The college downloads video programming via satellite to increase the diversity of educational materials used in the classrooms.*

USING FTS2000 FOR ELECTRONIC SERVICE DELIVERY

■ The Rationale and Role for FTS2000

Federal, nonmilitary long-distance telecommunications are purchased largely through two contracts for services known as the FTS2000 program, split 60/40 between AT&T and Sprint according to agency.[8] The Federal Government spends over $2.5 billion annually on telecommunications of all kinds (including local telephone service and special applications such as air traffic control and military command and control), of which about $500 million per year is on FTS2000.[9]

FTS2000 was designed to improve the internal and external communications of the Federal Government. A major strength of FTS2000 is that the government buys services, not equipment. FTS2000 is not intended to be technologically different from other large private or commercial networks. The contract was split between two vendors to promote a degree of ongoing competition and help to maintain equilibrium with the commercial sector. FTS2000 also is intended to provide the Federal Government with a universal and seamless telecommunications infrastructure:

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[5] See the August 1992 issue of *Communications of the ACM*, vol. 35, No. 8. See also John Adam, "Cryptography=Privacy?" *IEEE Spectrum*, vol. 29, No. 8, August 1992, p. 29.

[6] See the August 1992 issue of *IEEE Spectrum Magazine*, vol. 29, No. 8. See also U.S. Congress, Office of Technology Assessment, *Defending Secrets, Sharing Data*, OTA-CIT-355 (Washington, DC: U.S. Government Printing Office, October 1987).

[7] Foreign "hackers" once penetrated many sensitive military and intelligence networks using very simple techniques, such as using the default password supplied with off-the-shelf computers. See Clifford Stoll, *The Cuckoo's Egg* (New York, NY: Doubleday, 1989).

[8] FTS2000 vendors also lease lines from other long-distance carriers and satellite providers to obtain connectivity, and for primary and backup capacity. For example, in Alaska neither of the FTS2000 vendors provides direct commercial long-distance service, and they must therefore lease service from a regional carrier.

[9] Office of Management and Budget (OMB), *Current Information Technology Resource Requirements of the Federal Government: Fiscal Year 1993* (Washington, DC: U.S. Government Printing Office, 1992).

a common denominator to allow government agencies and computers to be more interconnected and compatible. FTS2000 consolidates considerable telecommunications procurement costs for agencies. Finally, FTS2000 is intended to save money when compared with the previous system (FTS) and the commercial market, since the government can buy services at a bulk rate.

FTS2000 was initially designed without electronic service delivery specifically in mind. It is, however, being used increasingly for electronic delivery, such as on-line bulletin boards and toll-free telephone lines. The FTS2000-based toll-free telephone services of the Social Security Administration and the Internal Revenue Service, for example, are considered the largest in the world.

The General Services Administration (GSA) manages the two FTS2000 contracts. The contracts are for 10 years, expiring in 1998, with renegotiations in 1992 (now completed) and 1995.[10] GSA levies a surcharge on users of FTS2000 for its overhead services, which include performing system tests, overseeing billing, managing consulting services, and conducting planning, among other tasks. GSA and the agencies obtain local telephone service through smaller non-FTS2000 contracts with local exchange carriers, and through the leasing or ownership of switching equipment. Agencies can purchase international voice service through a separate nonmandatory and governmentwide contract, but can also make their own international service arrangements. Agencies purchase end-user equipment, cellular service, and encryption on their own or through GSA. Table 3-1 compares telecommunication services provided by FTS2000 and the commercial market.

FTS2000 Issues

FTS2000 provides more opportunities than barriers to the electronic delivery of Federal services. Despite criticism regarding its early implementation, it is widely accepted that FTS2000 is a great improvement over the previous system (known as FTS).[11] With the earlier FTS, GSA managed long-distance services through contracts for equipment and leased lines, but had difficulty keeping up with changes in telecommunications equipment and services and agencies' needs. GSA estimates that in its first 4 years, FTS2000 saved $500 million over FTS. Early FTS2000 problems can be attributed, in part, to lack of experience on the part of the government and the telecommunications industry in managing contracts of this size, complicated by major changes in the industry following the divestiture of AT&T.

Need for Creativity Using FTS2000

About 85 percent of FTS2000 use is plain voice or low-speed data transmission for computers and faxes. Most current electronic delivery needs can be met with these or other FTS2000 services such as compressed video or packet switching. The main inhibitor to using FTS2000 for delivering services is not FTS2000 itself, but the lack of creativity by agencies in applying the potential that FTS2000 and other telecommunications already offer. Separate and traditional telephone and computer cultures still exist within the government; many agencies are not thinking or planning in terms of what FTS2000, or modern telecommunications in general, has to offer.

Need to Upgrade Non-FTS2000 Equipment

Government agencies still own considerable obsolete PBX switching equipment. ISDN and other digital services, as well as many digital

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[10] At the negotiations, GSA can adjust each vendor's percentage of the total contract, to reflect comparative prices and services. Since each vendor is awarded entire agencies to achieve its percentage of total revenue, with each agency changing its usage each month, the revenue split is never exactly as projected.

[11] For a history of FTS2000 and related congressional action, see U.S. Congress, House Committee on Government Operations, *FTS2000: Management Reforms and Intensive Congressional Oversight Ensure Savings of $500 Million for the Taxpayers* (Washington, DC: U.S. Government Printing Office, 1992). For a history of the events leading up to the final FTS2000 awards, see Bernard Bennington, "Beyond FTS2000: A Program for Change," app. A, "FTS2000 Case Study," 1989, report available from GSA.

Table 3-1—Comparison of Services Available: FTS2000 and the Commercial Market

Service	FTS2000	Commercial market[a]
Basic voice	Available	Available
Switched data	9.6, 56, and 64 kbps; 1.544 Mbps	9.6, 56, and 64 kbps; 384, 512, and 768 kbps; 1.544 and 45 Mbps
Dedicated data	Up to 1.544 Mbps; 45 Mbps	Up to 1.544 Mbps; 2.6, 6.2, 7.7, and 10.5 Mbps; 45 Mbps
Packet-switching	X.25	X.25, frame relay, TCP/IP (Internet), SMDS, ATM, and others
Compressed and wideband video	Available	Available
ISDN	Available	Available
EDI value-added services	Not available[b]	Available
International voice	Not available[b]	Available
Cellular	Not available	Available

[a] Not all services are commercially available across the entire United States.

[b] Available through a governmentwide contract other than FTS2000.

KEY: ATM=Asynchronous Transfer Mode; EDI=Electronic Data Interchange; ISDN=Integrated Services Digital Network; kbps=kilobits per second; Mbps=megabits per second; TCP/IP=Transmission Control Protocol/Internet Protocol; SMDS=Switched Multi-Megabit Data Service; X.25=protocol from the X.25 Accredited Standards Committee (ASC) accredited by the American National Standards institute (ANSI).

SOURCE: Office of Technology Assessment, 1993.

security features, are not possible with such equipment. The government should, in most cases, lease digital PBX equipment or centrex switching to avoid risky equipment purchases, since telecommunications equipment becomes obsolete well before it wears out.

Service Quality, Billing, and Interoperability Problems

Agency users have filed various complaints about FTS2000, including incomplete or delayed billing information, poor response to service calls, and slow processing of procurement requests. Many complaints stemmed from confusion during the initial stages of the conversion to FTS2000,[12] and from the inevitable technical problems of converting to a sophisticated digital system.[13] The vendors did implement FTS2000 ahead of schedule, and FTS2000 service reportedly continues to improve.

Agencies also have complained that some FTS2000 services (e.g., compressed video) are not interoperable between the two vendor networks.

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[12] Some agencies had to switch to an FTS2000 vendor from their preferred non-FTS2000 vendor to comply with the mandatory use policy. Others had to change FTS2000 vendors to meet quotas for the overall usage and revenue split between the two vendors.

[13] Performance, price, and interoperability are not easily compared. User demands are very unpredictable, making system design difficult. Each vendor packages its services differently. Also, laboratories cannot truly simulate real-world conditions because telephone networks are extremely complex.

In fairness, the video compression industry itself has lacked standards for interoperability. GSA may lack the motivation or negotiating power to entice or force the vendors to adopt interoperability more quickly. In order to deliver services to citizens more effectively, agencies will have to work together more closely, and interoperability will be essential in future contracts. As one agency official noted, interoperability is the "light at the end of the tunnel" for delivering services to the citizen.

A study commissioned by the FTS2000 Interagency Management Council determined that GSA could adopt a more customer-oriented approach, including streamlining or transferring some FTS2000 management tasks to the vendors.[14] However, the study also concluded that "GSA staff are very effective in executing their assigned responsibilities and mission. Their performance is at the root of a high level of satisfaction with the telecommunications services delivered." The study found that many agency reservations about GSA's role are due to a lack of understanding of GSA's oversight activities and its low-key approach.

Pricing Complaints

A major criticism of FTS2000 concerns pricing. One intent of the FTS2000 contract is to obtain services at a discount. Some agencies and outside parties have claimed that parts (or all) of FTS2000 cost more than equivalent services purchased on the open market, and that GSA did not exercise enough control to drive the vendors' prices down.[15–16] GSA acknowledges that prices were overly high for some specific services. GSA claims, however, that as of the 1992 price redetermination, FTS2000 prices were "at least as good as" the "best equivalent" commercial prices. FTS2000 prices were actually about 3 percent *higher* than commercial prices, however, if inconclusive comparisons are not included in the total.[17] GSA notes that commercial prices have fallen since the price redetermination, and FTS2000 prices fell after the first 1993 price cap evaluation. The related FTS2000 Interagency Management Council's contractor study on which GSA based its conclusions notes that the new price cap mechanism "represents a significant improvement over its predecessors," but that it "is not a complete guarantee of the lowest prices, however. Specifically, it cannot ensure the lowest FTS2000 price when most of the corresponding commercial services are purchased under individually negotiated, custom-designed contracts..."[18]

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[14] Booz-Allen & Hamilton, Inc., "Management Review of the GSA FTS2000 Program," Washington, DC, Nov. 20, 1992. Also see U.S. General Accounting Office, *FTS2000 Overhead: GSA Should Reassess Contract Requirements and Improve Efficiency*, report to the Chairman, House Committee on Government Operations, GAO-IMTEC-92-59 (Washington, DC: U.S. General Accounting Office, August 1992). GSA has reorganized its FTS2000 program office since these reports were issued.

[15] An early complaint was that the bidding process initially allowed the second lowest bidder (Sprint) to charge its agencies higher prices for equivalent services provided by the lowest bidder (AT&T). This resulted in higher prices for agencies forced to use the second lowest bidder. Later negotiations "levelized" or otherwise eliminated these differences.

[16] Jack Brock, General Accounting Office, *FTS2000: GSA Must Resolve Critical Pricing Issues*, report to the Chairman, Senate Committee on Governmental Affairs, GAO-IMTEC-91-79 (Gaithersburg, MD: U.S. General Accounting Office, September, 1991). A study by Putnam, Hayes, and Bartlett, commissioned by MCI, also found prices to be excessive. Putnam, Hayes, and Bartlett, Inc., "Money and Myth: Misconceptions That Shape Federal Telecommunications Procurement Policy," Cambridge, MA, Apr. 6, 1992.

[17] The breakdown is as follows: FTS2000 switched-voice prices, which constitute 78.1 percent of FTS2000 revenue, were equal to "best equivalent" commercial prices. For dedicated transmission and videoconferencing (about 16.7 percent of revenue), the FTS2000 prices were higher than commercial. FTS2000 packet-switching prices were less than commercial (4.7 percent), although the comparison cannot be considered conclusive since it "does not address the custom-designed packet systems . . . that dominate the market for large, sophisticated users. Further study may be required to determine the competitiveness of this service." Finally, the low volume of switched-data traffic (0.5 percent of revenue) "precludes a firm conclusion with respect to this service." U.S. General Services Administration, "The GSA Report to Congress on the Cost Effectiveness of the FTS2000 Program," February 1993; and Snavely, King & Associates, "FTS2000: Cost Effectiveness Comparison Acquisition Price Analysis," prepared for the Cost Effectiveness Subcommittee of the Interagency Management Council, January 1993. GAO concurs with GSA's conclusions. See Jack Brock, General Accounting Office, "GSA's Price Redetermination Yields a Reasonable Decision and Lower Prices," report to the Chairman, Committee on Governmental Affairs, U.S. Senate, March 1993.

The contractor report estimated that the overall FTS2000 price is $17 million to $52 million (4 to 13 percent) *lower* than commercial prices when expected costs for "unique government requirements" are included in the commercial prices.[19] The value of these unique requirements is, in many cases, subject to debate, difficult to quantify, and varies as the contract ages. Does a vendor recover certain costs in the first years of the contract, for example, or over the life of the contract? To reduce the risk to the government, vendors accept greater risk, which increases prices. How great is that risk, and how does it differ from commercial contracts?

Finally, the study only addressed *prices* for purchasing equivalent telecommunication services, and did not include the *overhead costs* for GSA to award and administer the contracts. Large private buyers or single agencies also would have overhead costs if services were procured outside of the FTS2000 program, but no comparison has been made between agency and GSA costs. The study "therefore does not purport to evaluate the total cost effectiveness of FTS2000 to the government." Another Interagency Management Council study determined that GSA could make changes to reduce its overhead operating charge, but that the overall effectiveness of FTS2000, not just a specific dollar number, is most important.[20]

Definition of Service Upgrade and Procurement Uncertainty

One objective of FTS2000 is that agencies should be able to choose from an up-to-date list of features and services. FTS2000 currently does not include many advanced telecommunication services. To obtain these services, GSA may add *features* to existing FTS2000 services, but the government is expected to issue separate competitive procurements for any new *services* unspecified in the original FTS2000 contracts. The result is ambiguity about what constitutes a typical upgraded "feature" to existing services, and what is an altogether new service outside the domain of FTS2000 that must be procured separately. Some new services are, as a consequence, disputed by FTS2000 competitors, and the provision of these services is delayed while the disputes are resolved.[21] These delays also increase uncertainty about FTS2000 within the agencies, and add to the existing overall uncertainty about rapidly changing telecommunications technologies.[22]

Optimum Contract Size

Customers who would otherwise negotiate very small contracts may gain the most from the economies of scale and scope of a larger contract; such economies result from reduced engineering costs per unit of service as more telecommunications traffic is aggregated.[23] Customers who are able to negotiate very large contracts, on the other hand, offer substantially more business to the winning vendor and therefore have greater negotiating power to obtain favorable prices and other contract considerations. Such large contracts, however, also carry greater risk and higher costs associated with moving the customer's business to another vendor, if necessary, in order to "carry out a threat" of selecting a lower priced competitor. Very large contracts can also influence the overall telecommunications market and therefore may have broader social and economic costs if competition is restricted as a result. The optimum contract size for procuring telecommunication services is unclear, and merits reconsideration given the substantial changes in the telecommunications industry.

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[18] Snavely, King & Associates, op. cit., footnote 17, p. 70.

[19] Without the unique government requirements, FTS2000 prices were found to be $6.7 million per year (2 percent) less than the "best equivalent" commercial prices. These requirements include assured and prioritized emergency service; billing arrangements; absorption of local access charges; and the government's options to terminate the contract at any time without liability, to reallocate more or less service, impose or change price-cap restrictions, etc. Ibid., p. 3.

[20] Booz, Allen & Hamilton, Inc., op. cit., footnote 14.

[21] None of the 23 FTS2000 protests (from over 200 contract modifications) has been decided against GSA, however. The GSA Board of Contract Appeals ruled against GSA in one case involving the addition of T3 services to FTS2000, but that case was recently overruled by the U.S. Court of Appeals.

[22] For example, an agency might prefer a new packet service from Vendor X (outside of FTS2000), but suspects that the FTS2000 vendor (Vendor Y) might soon provide the same packet service. In that event, GSA might *later* require the agency to purchase the packet service from Vendor Y, and the time spent on the procurement with Vendor X is wasted.

[23] Kalba Bowen Associates, Inc. and Economics & Technology, Inc., "Cost/Benefit Analysis of Alternatives for the Replacement of the Federal Telecommunications System Intercity Network," report prepared for GSA, Apr. 21, 1986.

FTS2000, in particular, may be much larger than the optimum size for a telecommunications contract. In any case, FTS2000 does not provide opportunities for agencies to experiment with smaller, competitive contracts. Some large agencies may be able to match their needs better outside of FTS2000, and may be large enough to negotiate contracts at lower prices and with terms more favorable to the government. In its February 1993 report to Congress, GSA noted that "better commercial prices can sometimes be obtained for geographically limited contracts or contracts which define very specifically the items to be bought."[24] Shopping for prices in this way currently is not possible with FTS2000.

The Mandatory Use Provision

FTS2000 use is mandatory for all agencies, unless GSA or Congress grants a specific exemption.[25] Mandatory use makes the total FTS2000 procurement "sweeter" for potential contractors; the larger market should result in lower contract bids. During the initial FTS2000 procurement, mandatory use was intended to attract enough bidders to provide at least some competition against the dominant carrier, AT&T.[26] Today, the telecommunications industry is more competitive, and mandatory use may not be necessary to assure a competitive procurement. Relaxing the mandatory use provision, on the other hand, may complicate oversight of FTS2000 and agency telecommunications generally, may increase costs especially for smaller agencies with limited negotiating power, and may or may not increase government procurement costs overall. GSA has not analyzed the effects of alternative contracting arrangements on costs or oversight.

GSA could experiment with contracting alternatives for some services and agencies in order to compare procurement and operational costs within and outside of FTS2000, and to evaluate how well possible FTS2000 follow-on options might meet agency needs. A key issue that may be illuminated is balancing the needs of smaller agencies and those with generic requirements that should benefit most from a full FTS2000 package, versus the needs of the larger agencies that may be able to negotiate more favorable terms through non-FTS2000 procurement of advanced telecommunication services. Contracting experiments could help identify ways to put more pressure on the FTS2000 follow-on vendors to keep prices of advanced as well as basic services competitive. If FTS2000 follow-on prices and services were truly competitive in meeting a wide range of agency needs, then user agencies would presumably opt to stay with FTS2000, even in the absence of mandatory use, unless there were other compelling reasons to go outside.

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[24] U.S. General Services Administration, op. cit., footnote 17, p. 3.

[25] The mandatory use provision requires agencies to use FTS2000 for all long-distance telecommunications, with exemptions allowed by GSA for certain mission-critical operations. Notable exemptions currently include much of the Department of Defense's traffic, the Federal Aviation Administration's air traffic control network, the National Science Foundation's NSFNET backbone, the Department of Treasury's Treasury Communication System, and Congress. On the other hand, the quasi-governmental U.S. Postal Service is not required to use FTS2000, but opted to use it anyway. The provision is included in the request for proposals and in Federal regulation as FIRMA Interim Rule 1, "Mandatory Federal Telecommunications System Network," July 29, 1988, 53 *Federal Register* 28638. Congress also has included the provision in annual appropriations legislation (Public Law 102-393, Sec. 622; Public Law 102-141, Sec. 622; Public Law 101-509, Sec. 620; Public Law 101-136, Sec. 621; and Public Law 100-440, Sec. 621). H.R. 3161, the "Federal Property and Administrative Services Authorization Act of 1991," included a provision to make mandatory use permanent, but the bill was not enacted.

[26] The first FTS2000 plan intended one vendor and voluntary use in order to keep prices low and make the transition to FTS2000 easier. This plan was revised to allow for two vendors, with mandatory use and price caps required for basic voice service, but not advanced services. The final FTS2000 plan included all services within the scope of the mandatory use provision. Price caps were extended to all services in 1990.

Relationship to Other Networks and Users

FTS2000 could connect to other government networks in the same way that it currently connects to commercial networks. That is, the vendors providing FTS2000 services could arrange to have equipment installed that would allow a seamless connection between FTS2000 and the individual State and local government networks. Commercial networks charge access fees to use their networks, however, and access arrangements would be needed with State and local government networks as well. Federal, State, and local regulations[27] might have to be revised to allow such arrangements. Also, the FTS2000 mandatory use provision requires that Federal users make all long-distance (inter-LATA) calls over FTS2000, thereby bypassing any internal State network. Thus, GSA or Congress may need to amend or authorize exemptions to the mandatory use provision for these cases.[28]

FTS2000 has no direct relationship with the NREN program, but it does serve as a vehicle for delivering some computer networking services. Agencies most likely will continue to obtain local Internet access without the need for long-distance services. If necessary, however, agencies can use FTS2000 to obtain Internet services indirectly from Internet providers, or perhaps directly at some future time.

The Follow-on to FTS2000

Even its strongest critics agree that FTS2000 is an improvement over the previous system. As the FTS2000 contracts pass mid-term, GSA will add features to its existing six basic services. GSA also will use the remaining time before contract expiration to plan, prepare, and finalize procurement requests for a follow-on to FTS2000, whatever form that will take. Competitors for a FTS2000 follow-on might include not only long-distance companies, but possibly computer network providers, manufacturers, and system integrators, among others. Changes in the telecommunications industry suggest the need for a fresh look at the overall objectives of a centralized program such as FTS2000.

Clarifying the Purpose of FTS2000

Congress could ask GSA and the administration to address basic questions about the purpose of FTS2000 in planning the mission of an FTS2000 follow-on.

- Is a direct follow-on to FTS2000 desirable? The centralized approach is not necessarily appropriate for modern telecommunications. Different agencies have different missions and needs for telecommunications to support electronic delivery; are these compatible with a single centralized contract?
- Should the principal mission of FTS2000 be to reduce the *internal* telecommunications costs for the government, or should it also focus on a more active role in delivering electronic services to citizens? Should GSA extend FTS2000 beyond traditional users (agencies and certain agency contractors) to, for example, federally funded groups that work in the public interest, such as schools, libraries, or local governments? If libraries found FTS2000 to be less expensive than commercial offerings, for example, or if the needed commercial services were unavailable, then they could participate in FTS2000 and be billed accordingly, as is each agency.

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[27] Including Federal procurement statutes such as the Competition in Contracting Act of 1984, Public Law 98-369, Sections 2701 *et seq.*, 98 Stat. 1175.

[28] The State of Iowa, for example, has installed fiber optic cables for its private network. A Federal agency calling from one county to a State office in another county might be required to use FTS2000 rather than the State system due to the mandatory use provision. See Iowa Communications Network Working Group, Interagency Information Resources Management Infrastructure Task Group, "Iowa Communications Network Study," report to the House Subcommittee on Treasury, Postal Service, and General Government, House Committee on Appropriations, U.S. House of Representatives, Apr. 1, 1993, p. 49.

The current conditions under which FTS2000 services can be extended beyond Federal agencies are not clear, however, and would need to be reviewed.

- Should the FTS2000 follow-on emphasize basic low-cost telephone service; an interoperable, advanced telecommunications infrastructure; or something in between? In other words, how is universal service defined for the Federal Government as customer? The first option implies a program with only basic voice, perhaps including ISDN service. The second implies a program with a full range of advanced services common to all government agencies. While both of these may be achievable in principle, in practice priorities must be set, and not all goals may be met by the vendors. Requiring many features in a contract can also limit competition, since fewer companies can manage such large systems. A set of several governmentwide specialized contracts may provide the same interoperable infrastructure without the difficulties encountered in maintaining a single large contract.
- Should FTS2000 and its follow-on save money overall, or should it save money on a service-by-service and agency-by-agency comparative basis? If the latter, should GSA continue to require agencies to purchase through FTS2000 to attract better rates from vendors, or should agencies have the option to go outside if they can get a better deal? In other words, should Congress and GSA retain the mandatory use provision? If so, should the provision be retained for all the services or only for some, such as basic voice and ISDN?

New Contracting Arrangements

Congress could ask GSA to review different contracting arrangements for an FTS2000 follow-on that are now possible given changes in the telecommunications industry.

- How many vendors are desirable for the follow-on contract? Advances in technology now allow contracting arrangements that were impractical during the planning of the present program 10 years ago. Any number of vendors could be allowed access to the agency switching centers—an "overlapping vendor" approach. Vendors could be selected on a real-time basis according to quality, service, or price. Or, agency traffic could be divided equally among pre-selected vendors qualified for specific services.

  The concept of switched competitive vendors has worked for other purposes. A Federal agency can currently switch its own calls dynamically to many different vendors; for example, to local, FTS2000, international, value-added, and advanced packet-switching vendors (see figure 3-2). Residential customers also can change long-distance carriers regularly, often with only an access code. The overlapping vendor approach described here would simply take these modern arrangements one step further. A diversity of vendors would be more competitive, and make Federal telecommunications more flexible and, in principle, more responsive to changing requirements.
- How should the contract be split among vendors? The present FTS2000 awards entire agencies to one of the two vendors. If one vendor provides better prices or service, however, GSA may or may not increase its share of the contract at the following renegotiation. Other arrangements are possible; the contract could be overlapping (as described above) or split by geographic region.[29] The FTS2000 follow-on planning merits a full review of these options, including their economies of scale and scope.
- Should a mandatory use provision be included in the follow-on to FTS2000? Mandatory use and FTS2000 reflect a centralized or "mainframe" approach to telecommunications that may not necessarily be appropriate for the late

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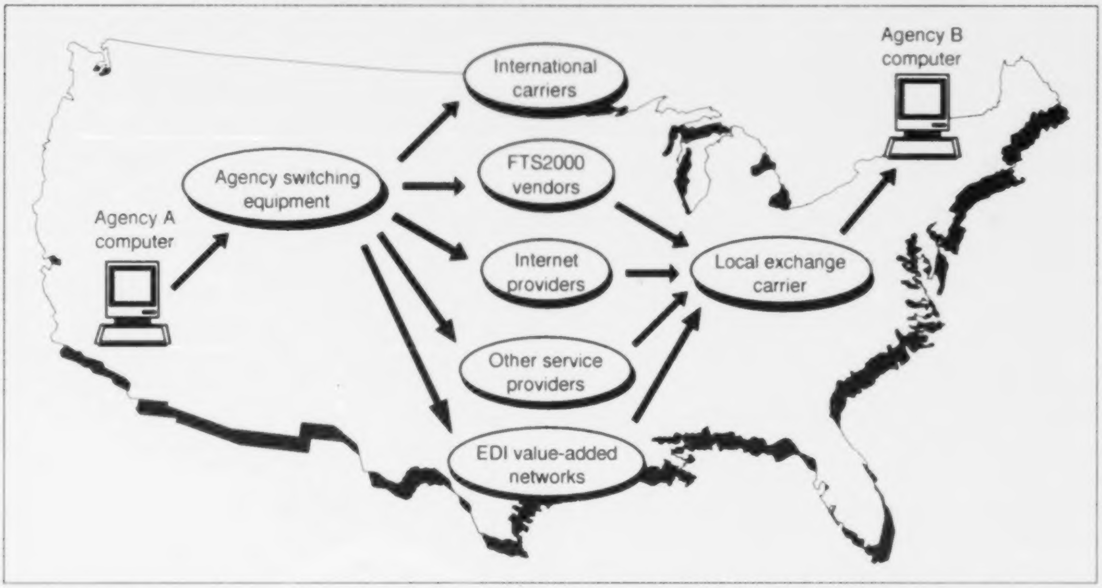
[29] Kalba Bowen Associates, Inc. and Economics & Technology, Inc., op. cit., footnote 23.

Figure 3-2—Existing Routes for Long-Distance Government Telecommunications



NOTE: The routes shown are illustrative. In this example, the sending agency (Agency A) switches the data directly to the appropriate telecommunications provider. At the receiving end, the local exchange carrier switches the data to the receiving agency (Agency B).

KEY: EDI=Electronic Data Interchange; FTS2000=Federal long-distance telecommunications program.

SOURCE: Office of Technology Assessment, 1993.

1990s and beyond. The overlapping vendor arrangement, for example, represents a more open, dynamic contracting system that rewards vendors for low prices and good service and allows for innovation among agencies. Prior to expiration of the current FTS2000 contract, GSA could conduct or sponsor contracting experiments to see if other options would better meet agency needs. Such experiments could be used to "pilot-test" possible contracting modifications or alternatives for the FTS2000 follow-on, and to compare the costs and benefits of agency procurements under a comparable set of contracting options.

- How long should the follow-on contract be? A 10-year contract may be too long and risky to plan modern telecommunication services, and it is longer than most large private-sector telecommunications contracts.

Adding FTS2000 Services

The overlapping vendor approach could also be used to obtain new telecommunication services as necessary through separate competitive contracts, eliminating debate over whether the services should be part of FTS2000 or not. If the overlapping vendor approach is *not* used for the follow-on, and *if* the FTS2000 follow-on includes a full range of services, should the contract be dynamic or static? What should constitute a new service requiring a separate procurement, and what is an acceptable modification to an existing contract? GSA could procure other advanced services either as part of the follow-on to FTS2000 or as separate governmentwide packages in order to realize discounts, simplify procurement, and encourage use. Separate procurements for telecommunication services outside the scope of FTS2000 may be more manageable in the short term, and perhaps could be implemented well before the follow-on to FTS2000. For the follow-on, including many or all services in a single FTS2000 package could strain the ability of the vendors to deliver the services well, and could limit competition. A large number of separate contracts, on the other hand, could significantly increase overall procurement and management costs.

- Either the follow-on or the current FTS2000 could include Internet access to simplify procurement and to encourage agencies to think more in terms of networking as part of normal operations. Internet access typically can be obtained through a local connection to a specialized Internet provider, without the need for long-distance service.[30] Providing access to Internet services within FTS2000 could be straightforward, however. One of the two FTS2000 vendors (Sprint) already provides its own TCP/IP packet-switched network for Internet access. Adding TCP/IP capability to FTS2000 could be an additional feature to the present packet service, perhaps within the terms of the present contract. GSA could also procure a nonmandatory governmentwide Internet contract, or agencies could continue to procure Internet services independently.
- Similar options apply to value-added services. FTS2000 does not directly provide full value-added network (VAN)[31] services. An agency might transport data over FTS2000 to the nearest value-added network gateway, but the traffic most likely travels to a local gateway and not over FTS2000 at all. Including value-added services that provide storing and forwarding of messages in the follow-on contract could encourage agencies to use electronic data interchange (EDI) and electronic benefits transfer (EBT). Value-added services may be provided best by different specialty vendors that are experienced with electronic commerce, however. The nonmandatory, governmentwide, value-added service contract is currently held by Sprint.
- Agencies also can purchase cellular telephone equipment and services much like they purchase local telephone service. Since cellular service is significantly different from long-distance service, it may be managed better independently of the FTS2000 follow-on. International service also could be included in the follow-on to FTS2000, but with no clear advantages. The government's nonmandatory international switched voice service contract is currently held by MCI.

USING COMPUTER NETWORKS FOR ELECTRONIC SERVICE DELIVERY

The Role of Computer Networking

A large computer network such as the Internet[32] is actually a network of smaller networks that interconnects all types of computers, from mainframes to personal computers.[33] Users around the

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[30] Currently, FTS2000 does not directly provide full Internet services, but an agency might use the FTS2000 network to transport data to the nearest Internet gateway. An agency wishing to access Internet services must first arrange for the switching through a regional or commercial provider. Then it must separately arrange dial-up or dedicated access to the provider through the local carrier or FTS2000.

[31] A value-added network provides special services such as storing and forwarding data packets for electronic data interchange. It may include special features for postmarking, archiving, retransmission, compliance checking, and interconnecting to other providers. FTS2000 users can send electronic documents using X.400 format electronic mail (called FTSMAIL), but without full value-added services.

[32] The Internet is sometimes defined as all the interconnected smaller networks that use the TCP/IP format to send data. In practice, the degree to which a network is part of the Internet varies, and other formats are sent over the Internet or used within subnetworks. This section focuses mainly on the Internet and the related NREN. See Ed Krol, *The Whole Internet Users Guide and Catalog* (Sebastopol, CA: O'Reilly and Associates, 1992). For a discussion of other networks such as Bitnet, Usenet, or Fidonet, see John S. Quarterman, *The Matrix: Computer Networks and Conferencing Systems Worldwide* (Bedford, MA: Digital Press, 1990). For a review of computer networks and their applications and issues, see the September 1991 issue of *Scientific American*.

[33] Banks and businesses have long used computer networks for electronic funds transfer, automatic deposit of checks, electronic data interchange, and so forth. However, these networks are managed privately or by commercial value-added providers, and are not discussed here. Commercial dial-up database services such as Compuserve, Prodigy, GEnie, or America Online are different yet, but have access to the Internet through electronic mail.

Nation can send messages, share computer memory and software, and access files and programs as if the network were one large computer. This decentralized computing has been likened to the Nation's roads; houses (computers) form communities (local area networks—LANs—and other networks) linked through streets (local telephone access lines) and highways (telecommunication backbones).[34,35]

Networking provides a completely new form of communication. It is two-way, like telephones; it provides broad access to information at any time, like television weather or news channels or audiotext; it allows for community input, like a newspaper's letter page; and it can transport large documents, like the postal service. The full impact of the Internet and computer networks is not yet fully understood, as users continually find new ways to use them.

As of July 1993, over 100 Federal Government networks were attached to the Internet. Some Federal services on the Internet include the Department of Agriculture's commodity market reports, Food and Drug Administration's electronic bulletin board, U.S. Geological Survey's geological fault maps, State Department's travel advisories, U.S. Postal Service's zip code directory, Project Hermes Supreme Court decisions available over Cleveland's Freenet, Library of Congress' card catalogs and congressional information, and National Oceanic and Atmospheric Administration's weather and climate information.

The National Research and Education Network (NREN) is a program to develop and extend networking applications in research and education and is part of the High Performance Computing and Communications Program (HPCC).[36,37,38] One goal for the NREN program is to advance supercomputer networking, pushing transmission speeds between large users beyond 45 Mbps rates: the so-called "information superhighways." Another NREN goal is to encourage new networking applications for educators, librarians, and others to provide much greater access to networked information. Pending legislation in Congress provides funding for computing and networking applications in manufacturing, education, libraries, health care, and government information.[39] NREN is intended to advance the overall national "information infrastructure" by helping to create new applications that will drive further private sector development of the collective telecommunications links, computer equipment, and other information technology needed to support computer networking.

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[34] Unfortunately, the analogy is often misunderstood, and ignores the fact that large computer networks are *virtual* networks. That is, telephone companies already have high capacity fiber and microwave transmission in place throughout the United States. The fiber and microwave transmission is used for both voice and data. In fact, 95 percent of the customer traffic flowing over the collective AT&T, MCI, and Sprint backbone network is over fiber, as is about 75 percent of the backbone traffic of the Bell operating companies. Some of this transmission capacity is then partitioned for the computer networks. Also, the analogy ignores the importance of developing new switching equipment and network management techniques to manage data traffic. Finally, such "data highways" could bypass some rural and inner city "back roads"—the Route 66 syndrome.

[35] The government role in computer networks would be different. Vice President Albert Gore, Jr. notes, "The idea of the Federal Government constructing, owning, and operating a nationwide fiber network to the home is a straw man. . . . It is a phony choice that some people see between a Federal public network, and no Federal involvement at all. In truth everyone agrees that there is an important role [for the government]." Graeme Browning, "Search for Tomorrow," *National Journal*, vol. 25, No. 12, Mar. 20, 1993, p. 67.

[36] High-Performance Computing Act of 1991, Public Law 102-194.

[37] For an explanation of gigabit research networks, see U.S. Congress, Office of Technology Assessment, *Advanced Network Technology*, OTA-BP-TCT-101 (Washington, DC: U.S. Government Printing Office, June 1993). See also Office of Science and Technology Policy, "Grand Challenges 1993: High Performance Computing and Communications," report by the Committee on Physical, Mathematical, and Engineering Sciences, Federal Coordinating Council for Science, Engineering, and Technology, n.d.

[38] For a history of NREN and related policy options, see Charles R. McClure, Ann P. Bishop, Philip Doty, and Howard Rosenbaum, *The National Research and Education Network (NREN): Research and Policy Perspectives* (Norwood, NJ: Ablex Publishing Corp., 1991). See also Brian Kahin (ed.), *Building Information Infrastructure* (New York, NY: McGraw-Hill, 1992).

[39] Introduced in 1993 as Title VI, the Information Infrastructure and Technology Act of 1993 (renamed the Information Technology Applications Act of 1993) included in S. 4, The National Competitiveness Act; and H.R. 1757, the High Performance Computing and High Speed Networking Applications Act of 1993 (renamed the National Information Infrastructure Act of 1993).

Computer Networking Issues

NREN and Electronic Service Delivery

Regardless of how the NREN program develops, Federal agencies can use the Internet for much of their computer networking and electronic service delivery. Relatively few government services are available on the Internet at present, however. Current use is mainly confined to electronic mail and file transfers, although the Internet has the potential to provide more powerful applications through such tools as Gopher software, Wide Area Information Servers (WAIS), searchable databases, graphics applications, information dissemination to subscriber lists, and so forth. Some agencies see the Internet as an important tool for reaching their client communities, while others perceive little value in the Internet and have no current plans to actively pursue its use. Many in government do not fully understand networking technologies and their potential applications.

Congress could clarify the purpose and intended beneficiaries of the NREN with respect to the delivery of government services.[40] Should government funding be provided to develop networking applications specifically for the delivery of services? Alternatively, should Federal funds directly subsidize recipients of networked Federal services?

Growing Pains

One strength of the Internet is its sheer connectivity—it is the largest computer network in the world. The Internet includes over 12,000 participating networks. It serves about 1.3 million computers and an estimated 10 to 15 million users in 127 countries.[41] Participation is growing by over 10 percent per month.[42]

The number of Internet users is growing so fast that the Internet is running out of available addresses, which necessitates changing the format of the packets used to send information.[43] The switches used to route the packets also are becoming overloaded. Higher network capacity requires new switches that are currently being tested in the HPCC testbed programs. The NREN progress is limited more by management and cost performance issues, however, than technology *per se*.[44] That is, participants have significant experience with the hardware, but a great deal remains to be learned about putting together and managing the system. Use of the Internet for electronic service delivery could place further stress on the system, and accentuate the need for upgrades.

Internet Pricing

An advantage for Internet users has been the flat fee structure and institutional support of portions of the Internet. Switching services and high-capacity dedicated links typically are provided at flat rates rather than based on direct usage. These fees are often offset by Federal and State grants to universities and other institutions, directly or indirectly. Institutions also pay for equipment and wiring, which often can be a substantial amount. Many individuals pay flat rates, or their costs are fully paid by an institution. The total Federal Government expenditures for Internet access are unknown, but may be less than 10 percent of total financing from governments, institutions, and corporate and individual users.

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[40] The NRENAISSANCE Study Committee of the National Research Council (NRC) has begun a study to develop a 5-year vision for the NREN program, including its relationship to the evolving national information infrastructure. NRC issued an earlier report on the issues of the NREN program, *Toward a National Research Network* (Washington, DC: National Academy Press, July 1988).

[41] These data are as of June 1993, and are impossible to know exactly since each address may have many users and each is managed separately from the overall network. The Internet management structure is historically academic and decentralized. With no central management, no single person or organization can list all Internet users. Each Internet provider is centrally managed, however, resulting in an arrangement much like States that agree on traffic laws and connect their roads at borders.

[42] Other networks are also growing rapidly. For example, Digital Equipment Corp.'s internal network includes over 80,000 computers in 37 countries. See Larry Press, "The Net: Progress and Opportunity," *Communications of the ACM*, vol. 35, No. 12, December 1992, p. 21.

[43] This is analogous to running out of available telephone numbers in the telephone numbering system. See Daniel P. Dern, "Internet Running Out of IP Address Space? Yes, No, and Maybe," *Internet World*, vol. 3, No. 7, September 1992, p. 13.

[44] U.S. Congress, Office of Technology Assessment, *Advanced Network Technology*, op. cit., footnote 37.

Prices for Internet access vary according to the application and the organization. If the connection is local, an individual might pay $9 per month for electronic mail access, or $19 per hour and up for full access. A rural school might spend $50 to $200 per month for dial-up or dedicated Internet access via modem; and a large corporation or university might pay $1,000 to $5,000 per month for 56 kbps to full 1.544 Mbps access. These Internet subscribers also must pay initial setup charges and the cost of leasing the necessary lines to get to the regional Internet provider. Dial-up 1-800 services are also available that bill the user according to minutes of service.

The Internet's rate structure likely will change in the future. New billing arrangements may make system management more complicated or expensive.[45–46] It is not clear how pricing may evolve and how changes might affect individual users. How will equity of access be assured? Will there be a tendency to serve wealthier commercial users, thereby pricing individuals, schools, and libraries out of the market? Will electronic advertising be allowed in order to support network providers? How will junk (unsolicited) electronic mail be defined and controlled, if at all? The utility of the Internet for government service delivery will be affected by decisions on how the Internet is priced.

Privatization of the NSFNET[47]

One of the participating Internet networks is the National Science Foundation's NSFNET. The NSFNET consists of three levels—the participating institutional networks, linked to regional not-for-profit and commercial network providers, which are, in turn, linked together through the high-capacity NSFNET backbone (see figure 3-3). The National Science Foundation partially supports the NSFNET backbone.[48,49]

The NSFNET is already essentially privatized, with the exception of the government support to some providers and many users described above. Privatization is expected to be complete in 1994, when NSF plans to award a new contract for very-high-speed-backbone network services (VBNS) limited to supercomputing applications. NSF will then end its support for the existing NSFNET backbone, and networks currently using it will have to make new arrangements, at some cost to each. These arrangements include leasing lines between networks and managing switching equipment. Several major network providers have formed a corporation—the Corporation for Regional and Enterprise Networking (CoREN)—to provide such backbone and other advanced computer networking services. The impacts of privatization on electronic delivery via the Internet are still unclear, and warrant close monitoring.

Local Access to the Internet

As with FTS2000, many Internet users depend on the local telephone carrier to enter the network and reach a user on the other end. This connection can be expensive for a rural user if the nearest Internet gateway requires a long-distance telephone call.[50] Internet access is therefore not equal for all citizens. If electronic service delivery over Internet becomes significant, the concept of uni-

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[45] One proposal for pricing Internet use, for example, has users bidding their maximum willingness to pay for access, with the priority given to the highest bidders on down until the network capacity is filled. At any given moment, however, all users on the network pay the same price, that of the last lowest priority user allowed on the network. See Jeffrey K. MacKie-Mason and Hal R. Varian, "Some Economics of the Internet," University of Michigan, Apr. 25, 1993.

[46] Eric Arnum, "The Internet Dilemma: Freeway or Tollway?" *Business Communications Review*, vol. 22, No. 12, December 1992, p. 28.

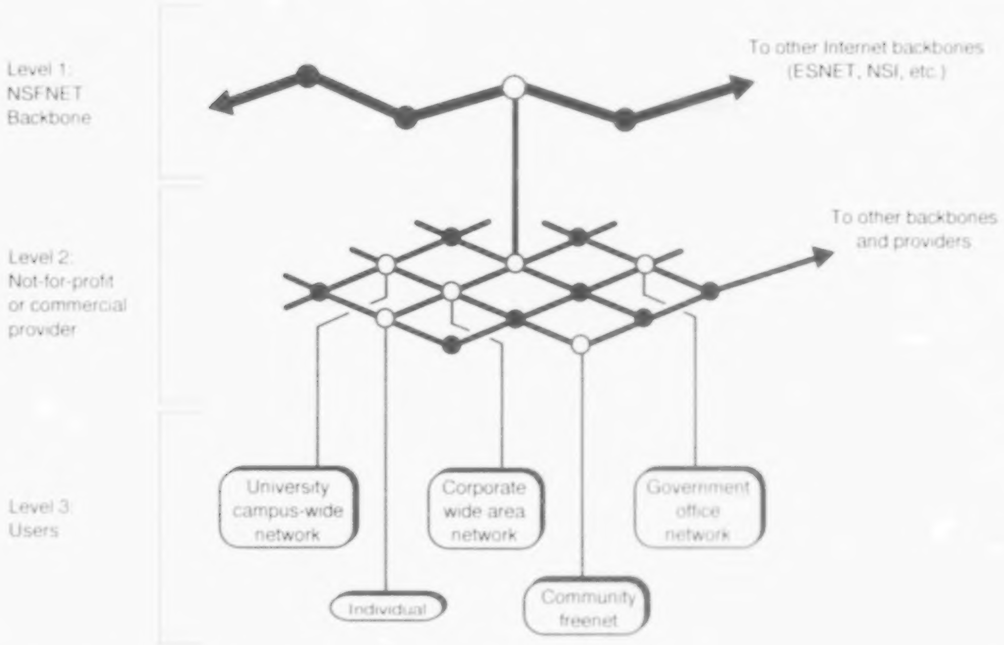
[47] The NSFNET operations are reviewed in Office of the Inspector General, National Science Foundation, "Review of NSFNET," report to the Subcommittee on Science, Committee on Science, Space, and Technology, U.S. House of Representatives, Mar. 23, 1993.

[48] Noncommercial networks and users are expected to use the federally subsidized portions of the Internet only for nonprofit research or education purposes—the Acceptable Use Policy. Commercial networks are not subject to this restriction, and often sell services over their networks.

[49] The NSFNET backbone itself has been supported by contributions from MCI and IBM ($60 million) and the State of Michigan ($5 million), as well as NSF (about $10 million per year). Regional and campus networks may have invested over 10 times this total amount.

[50] The cost is sometimes reduced by using the long-distance call only to download or upload information, and reading this information off-line.

Figure 3-3—The Three Levels of the NSFNET


Level 1:
NSFNET
Backbone
To other Internet backbones
(ESNET, NSI, etc.)
Level 2:
Not-for-profit
or commercial
provider
To other backbones
and providers
Level 3:
Users
University
campus-wide
network
Corporate
wide area
network
Government
office
network
Individual
Community
freenet

NOTE: The NSFNET backbone will be phased over to commercially provided backbones.

KEY: ESNET=Department of Energy's Energy Science Network; NSFNET=National Science Foundation Network; NSI=National Aeronautics and Space Administration's Science Internet.

SOURCE: Office of Technology Assessment, 1993.

versal service, usually referring to telephone service, could be redefined to include affordable access to Internet services.[51]

Local exchange carriers, FTS2000, long-distance carriers, or other providers could provide direct Internet access.[52] The local carrier could simply market or pass through the Internet access from a regional or commercial provider, for example, much as the local carrier currently connects and bills long-distance service to the home. Alternatively, the carrier could install its own gateways and sell the Internet access itself, in competition with other Internet providers. The local carrier would be acting much as it does with telephone service; that is, it provides connectivity to the outside world, but in this case through computer mail and file transfers rather than through voice communications.

Applications and User-Friendliness

As with the personal computer, the full potential of the Internet for citizens—whether for electronic service delivery or other purposes—will only be realized when applications are creative, easy to use, and relevant to their needs. If the government wishes to expand Internet use to schools, libraries, small businesses, or citizens-at-large through the NREN program, network applications and "information filters" must also help users manage the massive amounts of information appearing on the Internet. Otherwise, Internet use may continue to be concentrated primarily within the scientific, academic, and industrial research communities.

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[51] The Communications Act of 1934 creates the Federal Communications Commission to regulate commerce in communication "by wire and radio so as to make available, so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communications service with adequate facilities and reasonable charges. . . ." Communications Act of 1934, 47 U.S.C. 151, *et seq.* See also U.S. Congress, Office of Technology Assessment, *Critical Connections: Communication for the Future*, op. cit., footnote 1; and U.S. Department of Commerce, National Telecommunications and Information Administration, *The NTIA Infrastructure Report: Telecommunications in the Age of Information*, op. cit., footnote 1.

[52] For example, Sprint already has its own commercial TCP/IP packet-switching service.

Novice users may also require some human interaction on the network, such as on-line assistants to help with a service or to find an electronic address. These "on-line librarians" or "network assistants" could be provided by the network providers (like telephone operators), by each service contributor (like 1-800 help lines), by libraries, or by new commercial companies. The assistants might respond over the network interactively via electronic mail or by telephone.

A locator to government services available via Internet would be particularly useful. It could be a simple index for finding services and other directories, and could be managed by each individual agency, a single governmentwide agency such as the National Technical Information Service (NTIS) or the U.S. Government Printing Office (GPO),[53] and/or a private company. Federal agencies already operate more than 50 electronic locators, but not all are accessible on-line, much less via the Internet.[54] NSF has cooperative agreements that promise to develop "first and last resort" information services (InterNIC) and a directory of directories (including types of directories equivalent to "white" and "yellow" pages). These arrangements may not be sufficient for citizens looking for government services, however. New types of network locators, such as Gopher, WAIS, Archie, and World Wide Web use software that directs users automatically to file or database servers. Locators to government Internet services would also be useful via telephone, dial-up electronic bulletin board, CD-ROM, magnetic diskette, and print, at least until the general public is fully acclimated to computer networking.

Network Privacy, Ownership, and Control

Computer networks raise new issues of privacy and confidentiality, ownership and authentication, and information control and censorship—many of which are relevant to networked electronic service delivery. Regarding privacy,[55] what information can be gathered about users of computer networks such as the Internet? Should users be notified of all information gathered on them? Can the network provider sell that information? Should network users be able to obtain additional privacy? Who will enforce protection of network privacy? Commercial users often insist that their data traffic not travel over a competitor's network on the way to a destination. Some government applications may need to restrict network traffic to protect national security or the privacy of an individual's records. How will networks accommodate this? (Also see ch. 7.)

Regarding ownership, who owns the information on computer networks, and what can be copied legally?[56] Should the Internet be like a library, where one can borrow books and journals without a fee attached to the item? Should it be like the broadcast music industry, which pays songwriters a fee for every playing of a recording? Should it be like a bookstore, where one must pay in full for the book or journal? Current information gatekeepers maintain authenticity by producing recognizable publications or programs and through established reputations. Computer networks allow data to be easily manipulated or lifted from documents, however, and network data and document security is minimal at present. Who is responsible for maintaining the authenticity of documents transmitted over the network—authors/publishers, intermediaries, or users? Who should be liable for damage from, for example, a faulty software program obtained through the network—the user, the owner of a computer on which it was stored or distributed, or the author/publisher?

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[53] See the Government Printing Office Electronic Information Access Enhancement Act of 1993, Public Law 103-40.

[54] Charles R. McClure, Joe Ryan, and William E. Moen, School of Information Studies, Syracuse University, "Identifying and Describing Federal Information Inventory/Locator Systems: Design for Network-Based Locators," report prepared for the Office of Management and Budget, the National Archives and Records Administration, and GSA, August 1992.

[55] See James E. Katz and Richard F. Graveman, "Privacy Issues of a National Research and Education Network," *Telematics and Informatics*, vol. 8, Nos. 1 and 2, 1991, p. 71.

[56] Copyright issues of electronic information are discussed in U.S. Congress, Office of Technology Assessment, *Finding a Balance: Computer Software, Intellectual Property and the Challenge of Technological Change*, OTA-TCT-527 (Washington, DC: U.S. Government Printing Office, May 1992). See also Clifford A. Lynch, "The Accessibility and Integrity of Networked Information Collections," contractor report prepared for the Office of Technology Assessment, OTA-BP-TCT-109, March 1993; and Bruce Hartford and Jonathan Tasini, "Electronic Publishing Issues: A Working Paper," National Writers Union, New York, NY, June 30, 1993.

Who can or should control the information flowing over computer networks? Computer networks radically change the established methods and rules of free speech since the traditional gatekeepers—media owners and publishers—do not review the opinions. What rights and responsibilities do the new providers and users have? The government has a special responsibility to ensure fairness and protect free speech. If a statement is offensive or threatening, can a mediator edit or censor the discussion?[57] Widespread use of networking for electronic service delivery will intensify the need to address and resolve these issues. (Also see ch. 7.)

OTHER TELECOMMUNICATIONS INFRASTRUCTURE ISSUES

Importance of the Local Carrier—"The Last Mile"

Beyond FTS2000 and the Internet/NREN, several other telecommunications infrastructure issues are relevant to electronic delivery of Federal services. "The last mile"[58] is key for delivery of digital or high bandwidth government electronic services to citizens at home. If aging analog equipment is not replaced by more powerful digital equipment, regions with newer equipment may leave other regions behind. Booming regions with new fiber "superhighways" could leave behind many rural and inner city wire "back roads." Opportunities will be missed if sufficient telecommunication services are not available or affordable in the so-called "last mile" to disadvantaged Americans, telecommuters, librarians, and many others.

The local exchange carrier (LEC) has traditionally delivered telephone service the last mile to the home or office. Most switched transmissions must cross the LEC network at some point whether from the telephone, fax, modem, electronic kiosk, or automated teller machine. Even FTS2000 vendors must subcontract services from LECs, and Internet access requires transport through the LEC to reach the provider's switch.

There are some exceptions to using the LEC for electronic delivery of services over the last mile. New unregulated competitive access providers offer all-fiber digital telephone service in competition with LECs in some regions. Cellular and other wireless services can bypass the wire to the home, but cellular service is not available in many rural areas and is still quite expensive. Satellite links are effective for broadcasting or reaching remote or mobile locations, but currently are not practical for basic telephone services to the home. Cable television is available to about 97 percent of U.S. households; about 61 percent of all households subscribe.[59] Cable television, in theory, could be used for large-bandwidth switched services, but experiments with such switching are only in the earliest stages. Table 3-2 shows some telecommunications providers and the services they can deliver in the last mile.

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[57] The City of Santa Monica, CA, found that such "electronic town hall meetings" using their Public Electronic Network (PEN) system have been at times very useful, and allow the city to hear from a greater diversity of voices. The quality of a discussion sometimes degenerates, however. Although every user must register, the anonymity of a text-based discussion allows some users to dominate or intimidate others. See Pamela Varley, "Electronic Democracy," *Technology Review*, vol. 94, No. 8, November-December 1991, p. 43.

[58] "The last mile" refers to the part of the system between the customer and the nearest telecommunications switch.

[59] Dr. Richard Green, Cable Television Laboratories, Inc., written testimony at a hearing before the House Committee on Science, Space, and Technology, Subcommittee on Technology, Environment, and Aviation, Mar. 23, 1993. The data are from A.C. Nielson Co. and Paul Kagan Associates, Inc.

For digital or high bandwidth transmission to work, the carrier at each end of the line must have the necessary technical capability. New digital services such as ISDN are less useful if they are not universally available. Some high schools in Eastern Montana, for example, receive interactive two-way distance education via fiber optic lines, while the Little Big Horn College at a nearby Crow Indian Reservation still depends on analog telephone lines, and many of its residents have no telephone service at all. Despite the efforts of LECs to upgrade their physical plant, residents of rural areas, distressed inner cities, and other disadvantaged areas often receive upgrades last, since the LECs usually install new equipment first where their demand and revenues are greatest.

Federal and State policies on local carriers vary. Some State regulatory commissions perceive their role as keeping consumer prices low for basic telephone service, while others work proactively to implement advanced applications. This results in service variations across the Nation.

The Rural Electrification Administration (REA) has been successful in financing small private and cooperative LECs to deliver telephone service in rural regions, but the national standard of telephone service has been changing.[60] Almost 12 percent of rural households still do not have telephone service at all, and 12 percent of those that have service do not meet REA minimum specifications. Many who have standard service do not have access to ISDN or other digital services. Nearly all can access the Internet only through an expensive long-distance telephone call. The REA is still needed to finance existing and upgraded services, and it could redefine its minimum specifications to include more advanced services such as ISDN or local Internet access.

Traditional Copper, Modems, and ISDN

An alternative to installing new fiber optic cable and switched broadband to deliver information

Table 3-2—Providers and Technologies Delivering Services in the "Last Mile" to the Home

Service or technology	Telephone companies	Cable television companies	Mobile providers	Terrestrial broadcast stations	Satellite providers
Basic voice	Yes	Pilot/demo	Yes	Yes (one-way)	Proposed
Slow data	Yes	Pilot/demo	Some	Proposed (one-way)	Yes
Fast data	Proposed	Proposed	Proposed	No	Proposed
One-way broadband	Pilot/demo	Yes	No	Yes	Yes
Two-way broadband	Proposed	Proposed	No	No	No
Packet-switching	Some	Proposed	Some	No	Yes

Some categories overlap; for example, two-way broadband will likely be delivered using packet-switching. Some services are available for large customers, but are not publicly available or available to the home.

SOURCE: Office of Technology Assessment, 1993.

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[60] See also U.S. Congress, Office of Technology Assessment, *Rural America at the Crossroads: Networking for the Future*, OTA-TCT-472 (Washington, DC: U.S. Government Printing Office, April 1991).

to homes, schools, libraries, and offices is to make better use of the present substantial investment in copper-wire cables. Fast modems can transmit data up to 28.8 kbps on analog lines, much faster than many of the current modems that operate at 1.2 or 2.4 kbps. Plain copper wires using ISDN services[61] or other digital technologies can achieve a tenfold improvement in data rate over most modems. Using high-bit-rate digital subscriber line (HDSL) and asynchronous digital subscriber line (ADSL) technology,[62] copper wires can reach one-half T1 (768 kbps) and full T1 (1.544 Mbps) rates at distances over 2 miles. Using local area network protocols, copper can reach 100 Mbps over short distances. Whereas digital video once required 90 Mbps transmission, even 56 kbps is now sometimes acceptable for video due to advances in data compression. Put simply, ISDN, HDSL, and ADSL terminals serve as highly advanced transceivers—modems, in a sense—that correct for the limitations of the copper wires. These advanced technologies may meet the needs of most users for years, and without the cost of new cable installation.[63]

FRED B. WOOD

Digital switching center at the OTZ Telephone Cooperative in Kotzebue, Alaska. Rural and urban areas alike depend on modern digital switching and transmission technologies to provide high-quality, low-cost telephone service.

ISDN essentially moves much of the control features of the central switch to the user's telephone or switch. ISDN is well suited for telephone and on-line services and videoconferencing for users of all kinds, including small businesses, telecommuters, students, and health care workers. ISDN can send switched voice, fax, electronic mail, video, and packets over a single pair of copper wires that previously carried only voice or data—and more than one type of transmission at the same time. This is possible because ISDN is digital and uses "out-of-band signaling," which allows for special control functions and variable bandwidths.

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[61] ISDN (Integrated Services Digital Network) is sometimes called *narrowband* ISDN to differentiate it from *broadband* ISDN (BISDN). BISDN integrates digital voice, data, and video signals like ISDN, but is otherwise very different (see discussion of switched broadband in the following section).

[62] HDSL and ADSL are new services that also obtain more bandwidth out of the existing copper wires, but ISDN provides more control and functionality. Using the same copper wires needed for ordinary telephone service, but new technology at each end, one can obtain two-way 786 kbps transmission (HDSL), or one-way full 1.544 Mbps transmission with a 64 kbps voice channel in the other direction (ADSL). HDSL and ADSL may eventually provide video-on-demand entertainment, distance education, telemedicine, and videoconferencing to homes, schools, clinics, and businesses. See, for example, Gerald A. Greenen and William R. Murphy, "HDSL: Increasing the Utility of Copper-Based Transmission Networks," *Telecommunications*, vol. 26, No. 8, August 1992, p. 55. See also T. Russell Hsing, Cheng-Tie Chen, and Jules A. Bellisio, "Video Communications and Services in the Copper Loop," *IEEE Communications Magazine*, vol. 31, No. 1, January 1993, p. 62.

[63] Database servers also can be used to reduce the amount of information transmitted. The remote computer (the server) does the database queries quickly and sends only the results over a slow wire. The user's local computer (the client) receives the results and can display them off-line, without tying up the wire with the entire database information.

ISDN requires ISDN-compatible and independently powered equipment at each end, whether it be a telephone, fax, or computer interface. ISDN also requires that the long-distance and local telephone companies install software using the Common Channel Signaling System 7 (SS7) format in digital central office switches. The major long-distance companies have installed SS7, but the local telephone companies are moving more slowly. Only when SS7 is available is ISDN even an option for the consumer, who can then purchase ISDN terminal equipment and order the service. The first end-to-end long-distance ISDN call was made in summer 1992.

Like many services, ISDN is an example of the chicken-and-egg problem. New services often are not useful unless they are ubiquitous, but they will not be ubiquitous unless users or providers perceive that the services are useful. Consequently, LECs vary in their marketing strategies and schedules to deploy ISDN.[64] Europe and Japan are ahead of the United States in percentage of telephone lines with ISDN accessibility, but the United States is ahead in lines actually used for ISDN.[65] Tariffs for private lines in Europe are relatively more expensive, however, making comparison of services difficult.

ISDN standards also vary nationally and internationally, but only to a small degree. The 25 or so different versions of ISDN standards are expected eventually to be interoperable, and will likely converge as companies upgrade their ISDN offerings.

Confusion over standards and high prices, and market ignorance about what ISDN really is, have resulted in delays and an image problem for ISDN implementation. Much of this delay is due to inexperience in planning and marketing on the part of the Bell operating companies after the divestiture of AT&T. Before divestiture, AT&T could more easily implement and market a single standard and compatible user equipment nationwide.[66] Europe also has had difficulties in planning and marketing ISDN, however, due to the transition from public monopolies to a competitive private sector.[67]

Recently, ISDN has received support on the basis of its lower overall cost to the consumer compared to a broadband fiber network,[68] although prices are still quite high (about $800) for an ISDN telephone. The cost of implementing ISDN has been placed at about $45 billion, excluding user equipment.[69] In comparison, local telephone companies spend about $20 billion per year for upgrades.[70] These upgrades include converting to the SS7 format, which is necessary for rapidly expanding 1-800 services as well as ISDN.[71] This $45 billion figure compares to over

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[64] Bell Atlantic, for example, had 49 percent of its network ISDN-capable in 1992, and expects to reach 87 percent in 1994; Southwestern Bell had 16 percent deployment in 1992, and plans 21 percent in 1994. Daniel Briere and Mark Langner, "Users Wonder if ISDN Can Endure," *Network World*, vol. 9, No. 38, Sept. 21, 1992, p. 29.

[65] France and Singapore had 100 percent ISDN-capability in 1990, and the former West Germany and Japan expect 100 percent capability by 1994. Department of Commerce, National Telecommunications and Information Administration, op. cit., footnote 1, p. 185. Dan Stokesberry and Shukri Wakid, "ISDN in North America," *IEEE Communications Magazine*, vol. 31, No. 5, May 1993, p. 93.

[66] For an overview of ISDN implementation, see Kathleen M. Gregg, "The Status of ISDN in the USA," *Telecommunications Policy*, vol. 16, July 1992, p. 425.

[67] Gerhard Fuchs, "ISDN—The Telecommunications Highway for Europe After 1992?" *Telecommunications Policy*, vol. 16, November 1992, p. 635. See also John Early, "Opening the Channels of ISDN," *Telecommunications*, vol. 27, No. 3, March 1993, p. 44.

[68] See Mark N. Cooper, "Developing the Information Age in the 1990s: A Pragmatic Consumer View," Consumer Federation of America, Washington, DC, June 8, 1992. See also "The Open Platform" and "Innovative Services Delivered Now," the Electronic Frontier Foundation, Washington, DC, n.d.

[69] Bruce L. Egan, "Benefits and Costs of Public Information Networks: The Case for Narrowband ISDN," Columbia Institute for Tele-Information, Columbia University, New York, NY, February 1992.

[70] About one-fourth of this amount is for new central office equipment, one-fourth for new copper installation, and 7 to 9 percent for new fiber cable installation. See Carol Wilson, "LECs Gear Up for Competition," *Telephony*, vol. 224, No. 4, Jan. 25, 1993, p. 33.

[71] Karen Archer Perry, "The Race to Deploy SS7," *Telephony*, vol. 223, No. 3, July 20, 1992, p. 25. See also Dave Powell, "Signaling System 7: The Brains Behind ISDN," *Networking Management*, vol. 10, No. 4, March 1992, p. 36.

$200 billion for fiber installation and switched broadband, also excluding the user equipment.

Fiber and Switched Broadband Services

Another "last mile" issue is the replacement of copper wires with glass fibers to homes or neighborhoods. Fiber optic transmission has been hailed as a means to revolutionize the delivery of government services, education, home entertainment, and the workplace. This "fiber-in-the-loop"[72] technology could ultimately deliver gigabits of information per second—equivalent to many channels of video information or tens of thousands of telephone calls. Telephone companies already use these fiber cables for telephone traffic between central offices. Many organizations use fiber for interoffice computer networks, and some telephone and cable companies have pilot programs using fiber in the last mile.

An important distinction in this discussion is between one-way broadband and two-way broadband services, or between unswitched and switched broadband. Fiber-in-the-loop currently is only capable of carrying mostly one-way, relatively unswitched transmissions, such as on-demand cable television. Two-way, fully switched services of all kinds may be possible in the future as the technology becomes available and affordable.[73] Such fully switched broadband services would integrate voice, data, and video, and would therefore require new end-user equipment.

Broadband network laboratory at the Pacific Bell facility in San Ramon, California. Many commercial companies are developing and testing systems for the transmission and switching of wide bandwidth signals.

Many experts and advocates agree on the eventual need for an improved telecommunications infrastructure using fiber and switched broadband services.[74] The question is how and when it should be implemented. Faster implementation would presumably put the United States at a competitive advantage compared to other countries, much as it would give one State an advantage over others. But this investment has several risks:

1. Services delivered by fiber must compete with other technical and market alternatives. Cable television already supplies great bandwidth in one direction over coaxial cables or wireless technology. Cellular and other wireless technologies promise large bandwidths—some as high as one gigabit per second—and more flexibility.[75] With data compression technology, traditional copper wires can transport larger amounts of information more efficiently. Direct broadcast and other satellite providers could be strong competitors for data and video, and allow the customer to move locations easily. Compact video disks, vide-

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[72] The fiber might go to the home (fiber-to-the-home), to a neighborhood box (fiber-to-the-curb), or to the nearest neighborhood switch (fiber-to-the-neighborhood). In the latter two cases, existing coaxial cable and copper wires would carry the transmissions the final distance to the home. Unless otherwise specified, fiber-in-the-loop here refers to any of these three architectures.

[73] The technology to switch broadband for this and other applications (such as for supercomputers) is the focus of the High Performance Computing and Communications (HPCC) Program, which includes the NREN.

[74] See Institute for Information Studies, op. cit., footnote 1. See also Martin C. J. Elton (ed.), *Integrated Broadband Networks: The Public Policy Issues* (New York, NY: Elsevier Science Pub. Co., 1991).

[75] GTE Corp. recently made Quitaque, Texas the first wireless city when it converted the 700 residents from a wired to a wireless telephone system. See *Telecommunications Reports*, vol. 58, No. 49, Dec. 7, 1992, p. 15.

otapes, and CD-ROMs are strong competitors to provide entertainment and database information. Broadband *to the home* is more likely to redistribute revenues among these different providers than to drastically increase net revenues and change consumer lifestyles. The redistributed revenues will come primarily from those citizens with more disposable income.

2. Switched broadband could be overkill for most consumers for many years. FTS2000 and the commercial telephone systems are used mainly for voice calls or low-speed data transmission, even though many more services are possible. Previous experience with videophones failed, but not because of technology (which used existing analog switching and copper wires). Videophones failed because of the lack of customer interest and lack of connectivity (the chicken-and-egg problem of needing a minimum number of users to provide value).[76]

   Twenty years ago, interactive two-way service over coaxial cable also was heralded, much as fiber-to-the-home is today. The two-way cable movement failed because the switching technology was more costly than expected, consumers had little interest in two-way services, the cable industry was not interested or prepared to provide such systems, and the telephone industry was not interested in one-way television.[77]

   Today, the telephone industry is interested in providing one- and two-way video information and entertainment services if they can deliver advanced features such as video-on-demand, more channels, or better quality through high-definition television.[78] Such interest could drive fiber installation, and other equipment could be converted to switched broadband much later depending on cost and demand.

3. The cost of fiber-in-the-loop is high; the cost of switched broadband is even higher. Estimates of the total costs of implementing fiber-to-the-home by the telephone companies vary from $200 billion to over $1 trillion,[79-80] while fiber-to-the-curb or neighborhood would be much less. Cable television providers might provide nonswitched broadband using fiber and existing coaxial cables for about $20 billion. Costs include laying fiber cables to the user, and installing switching and other equipment. To fund the investment, regulatory agencies could allow telephone companies to shorten depreciation schedules to match true equipment lifetimes. Overall prices could be allowed to rise, or providers could finance the investment from sales of new services. Alternatively, a usage tax placed on all providers could subsidize the high-cost subscribers in order to guarantee universal service.[81]

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[76] Many consumers have indicated that videophones seemed useful to others, but were not perceived as personally useful. In one study, consumers indicated they would actually pay *not* to be seen on a videophone. A. Michael Noll, "Anatomy of a Failure: Picturephone Revisited," *Telecommunications Policy,*. vol. 16, May/June 1992, p. 307.

[77] A. Michael Noll, "The Broadbandwagon! A Personal View of Optical Fibre to the Home," *Telecommunications Policy,* vol. 13, September 1989, p. 197.

[78] Two telephone companies recently announced plans to supply broadband services to the home using fiber-to-the-neighborhood technology. US West plans to have 30 percent of its switches connected by the year 2000, with the rest connected by the year 2025. Pacific Bell plans to connect 50 percent of its lines by the year 2003, and 100 percent by the year 2015. A cable provider, Tele-Communications Inc. (TCI), recently announced a $2 billion fiber-to-the-neighborhood plan (using existing coaxial cable to the home) for 90 percent of its customers by 1996. The TCI system promises to carry the equivalent information of 500 compressed television channels compared to the present 50.

[79] This is about $2,000 per household averaged over 100 million households. Bruce L. Egan, "The Case for Residential Broadband Telecommunications Networks," Columbia Institute for Tele-Information, Columbia University, New York, NY, February 1992. See also Bruce L. Egan, *Information Superhighways: The Economics of Advanced Public Communication Networks* (Norwood, MA: Artech House, 1991); and David P. Reed, *Residential Fiber Optic Networks: An Engineering and Economic Analysis* (Norwood, MA: Artech House, 1992).

[80] Nippon Telephone and Telegraph Corp. (NTT) recently abandoned its goal of installing fiber optics throughout Japan by the year 2015, and then reinstated it again. NTT estimates the investment at $400 billion. *Telecommunications Reports,* vol. 59, No. 16, Apr. 19, 1993, p. 8.

[81] Bruce L. Egan and Steven S. Wildman, "Investing in Telecommunications Infrastructure: Economics and Policy Considerations," in Institute for Information Studies, op. cit., footnote 1.

4. Switched broadband must overcome significant technical problems.[82-83] Experts are concerned that packet delays and bandwidth management may be overly complex, adding to costs. Providing main and battery backup power to electronic transceivers is not a trivial engineering or regulatory problem and involves cost, safety, and maintenance tradeoffs. Present analog (nondigital) video entertainment may be transmitted more cost effectively over coaxial cable due to the extreme requirements of analog transmission.
5. Without standards, switched broadband could develop with many noninteroperable formats and types of equipment, and the full opportunity would be missed. That is, users would face greater risks when choosing service and equipment, and participation would be much less inviting. The experience of narrowband ISDN proved that the divested Bell companies were less than successful in resolving such issues and marketing ISDN. The industry may have learned from that experience, however. The ATM Forum, for example, has over 150 members dedicated to standards for broadband packet-switching technology. The government also could act to promote standards—not to choose them, but rather to motivate industry to develop and adopt them.

   One solution to the problem of noninteroperable formats and equipment might be to require all local carriers—telephone companies, cable companies, etc.—to serve as common carriers for all types of content providers. They would then have a strong incentive to maximize connectivity and operability for all subscribers; at the same time, first amendment guarantees of free speech would be strengthened.[84] This might also lessen conflict between the interests of content providers versus connectivity providers.
6. While switched broadband and a fiber infrastructure are worthwhile long-term goals, intermediate solutions such as ISDN and fast modems will coexist, and should not be overlooked when forecasting future telecommunications needs. Even if switched broadband appears soon, it will develop in parallel with other services for the foreseeable future.[85,86,87] Federal agencies, in sum, need not wait for widespread implementation of fiber and broadband technologies to improve government services through electronic delivery.

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[82] See George T. Hawley, "Break on Through to the Other Side," *Telephony*, vol. 220, No. 2, Jan. 14, 1991, p. 38; and Dustin J. Becker, "Power Problems in the Fiber Loop," *Telephony*, vol. 218, No. 3, Jan. 15, 1990, p. 46.

[83] Donald E.A. Clarke and Tetsuya Kanada, "Broadband: The Last Mile," *IEEE Telecommunications Magazine*, vol. 31, No. 3, March 1993, p. 94.

[84] Henry Geller, "Fiber Optics: An Opportunity for a New Policy?" Annenberg Washington Program, Northwestern University, Washington, DC, 1991.

[85] Vice President Albert Gore, Jr., said that "there is nothing inconsistent between pursuing ISDN as a useful stepping-stone, while at the same time encouraging more-rapid development of fiber and wireless networks capable of carrying full, uncompressed video and other applications . . ." "In fact, it's unlikely that the backbone network will involve a great deal of new fiber at all. It'll involve some, but most of the fiber we need is already there. What we need is new switches, new software, new standards that vastly upgrade the capacity of existing fiber to accommodate the extremely large data flows that a gigabyte network will feature." Graeme Browning, op. cit., footnote 35.

[86] John Sculley, former Chairman of Apple Computer, Inc. and an advocate of broadband technology, said that the collection of interconnected networks could use a variety of technologies including ISDN as a starting point, and that it would be a mistake to be "locked into a single technology." Sculley also said that fiber to the home is not currently a justifiable investment for the private sector, since it is not clear what services and products will sell. Testimony by John Sculley before the House Committee on Energy and Commerce, Subcommittee on Telecommunications and Finance, Jan. 19, 1993.

[87] Lawrence Gasman, "The Broadband Jigsaw Puzzle," *Business Communications Review*, vol. 23, No. 2, February 1993, p. 35.

Electronic Benefits Transfer for Social Service Delivery

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SUMMARY

Electronic benefits transfer (EBT) is a feasible alternative to paper-based systems for delivering government benefits and services. The Federal Government can lead the way in implementing a nationwide EBT system. Congress and the President need to act quickly on EBT, however, if opportunities for integrating services and capturing economies of scale are to be realized; otherwise Federal agencies and States will continue to move in their own directions creating potentially incompatible and uncoordinated EBT systems.

EBT tests and evaluations indicate that it is proven, reliable, easy to use, and decreasing in cost. Recipients, retailers, financial institutions, and local program administrators who have tried EBT prefer it to paper checks or coupons. It can yield significant cost savings to retailers, recipients, financial institutions, and government agencies. Recipients using EBT experience an added sense of dignity and security. EBT can help to integrate the delivery of several social services benefit payments and simplify the process of issuing and redeeming benefits. It also reduces fraud and abuse, such as diversion of benefits for unauthorized or illegal purchases (although new forms of electronic fraud may arise). EBT is most likely to be cost effective if it includes multiple social service programs and uses a standardized commercial infrastructure.

Despite these optimistic findings, sufficient information is not available to assure cost-effective EBT or to make technical decisions on nationwide implementation—such as a national roll-out of EBT for food stamps using a magnetic stripe card. Federally supported pilot tests have assessed the use of magnetic stripe cards fairly thoroughly, but have given only limited attention to smart

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cards and have entirely overlooked hybrid cards (that combine features of both magnetic stripe and smart cards).

The next logical step toward nationwide EBT deployment is a scaled-up, multiple-program, and regionally based EBT feasibility test. If properly designed and evaluated, the test would determine the total cost to the Federal Government, States, and the private sector of developing, implementing, and operating a national EBT system. In order to determine the optimal design of a national system, the test should include on-line and off-line approaches, as well as magnetic stripe card, smart card, and hybrid card technologies. The test should explore different levels of cooperation between Federal/State and public/private sectors, and develop EBT cost-sharing and standardized EBT operating rules and procedures. The test also should identify the most effective mechanisms for Federal/State leadership and interagency coordination on EBT.

Various Federal laws and regulations will need to be reviewed and possibly revised to facilitate a transition to EBT. These include the Food, Agriculture, Conservation, and Trade Act of 1990; the Privacy Act of 1974; the Computer Security Act of 1987; Federal financial laws; banking legislation and regulations; and the enabling laws and regulations of each government program participating in EBT.

The transition to a national EBT system will be difficult and complex, but it is now possible. Strong Federal leadership and coordination, combined with meaningful State Government and private sector participation, will help to assure success. In the end, EBT offers the potential to improve the quality, integrity, and cost effectiveness of many Federal and State social service benefit programs.

THE POTENTIAL OF ELECTRONIC BENEFITS TRANSFER

EBT Scenarios

The following two fictional scenarios illustrate how policy decisions being made today will affect the development and usefulness of EBT. The first scenario assumes that the Federal Government establishes a strategic long-term plan for a national EBT system. Federal and State agencies work cooperatively with the private sector to develop an integrated national EBT system that serves multiple programs and accommodates both on-line and off-line applications. The second scenario assumes that Federal and State agencies develop their own EBT systems with little or no coordination or policy guidance from the Federal Government.

One-Card EBT

Mary Citizen is a 37-year-old, single mother of two who recently was laid off from a computer assembly plant in southern New Hampshire. She is on her way to Lowell, Massachusetts, where she attends a federally sponsored job-training program. Upon arrival, Mary presents her Federal Social Service (FSS) card to a job counselor, who inserts the card into a computer and debits Mary's job-training benefits account.

On the way home, Mary stops at a supermarket 10 miles south of the New Hampshire border to purchase groceries. Inside, she suddenly remembers that she has not obtained her benefit allowance from the Women, Infants, and Children's Program. Instead of driving all the way to the WIC clinic, Mary simply inserts her FSS card into a reader at the customer-service counter where her benefits are automatically added to the card. She purchases some food items and infant formula.

At the checkout counter, Mary inserts her FSS card into a point-of-sale terminal that accepts smart cards and magnetic stripe cards for both commercial and government programs. Once all the items are scanned, the card-reader automatically deducts the appropriate amounts from her WIC and food stamp accounts.

Back in New Hampshire, Mary realizes that she needs cash to pay the babysitter. Stopping at her local ATM machine, she inserts her FSS card and obtains cash from her Aid to Families with Dependent Children account. Mary has conducted transactions in two States, and accessed several different benefit programs, with only one card that can be used in any ATM or POS device nationwide.

Multiple-Card EBT

Mark Public is 67 years old, retired, and living in Jacksonville, Florida. He is partially disabled as a result of a back injury sustained during his career as a Captain in the U.S. Navy. Mark receives physical therapy once a week on the naval base. He must show proof of identity before entering the naval compound. Today, Mark is in a hurry. At the base gate, he pulls out his wallet and realizes that he left his other wallet at home—the second one he must now carry to accommodate the increasing number of identification and benefit cards. Mark has to drive all the way home to get his cards.

Back on base, at the physical therapist's office, Mark must present his Military Benefits Card. Here he learns that his benefits for the year have been consumed, and he must drive to the other side of the base get additional benefits added to the card before he can get his therapy.

Later in the day, Mark decides to visit his daughter and grandchildren who live in a small town in Georgia, just over the Florida State line. He discovers that he's short of cash needed to treat his grandchildren to a movie, so he stops at a local ATM in Georgia. Here Mark needs to use two cards: one to withdraw funds from his Social Security account and another to access his Disability Income account. Mark discovers, to his dismay, that the Georgia system is incompatible with the Florida system, and that he cannot access his benefits. Mark has to borrow cash from his daughter.

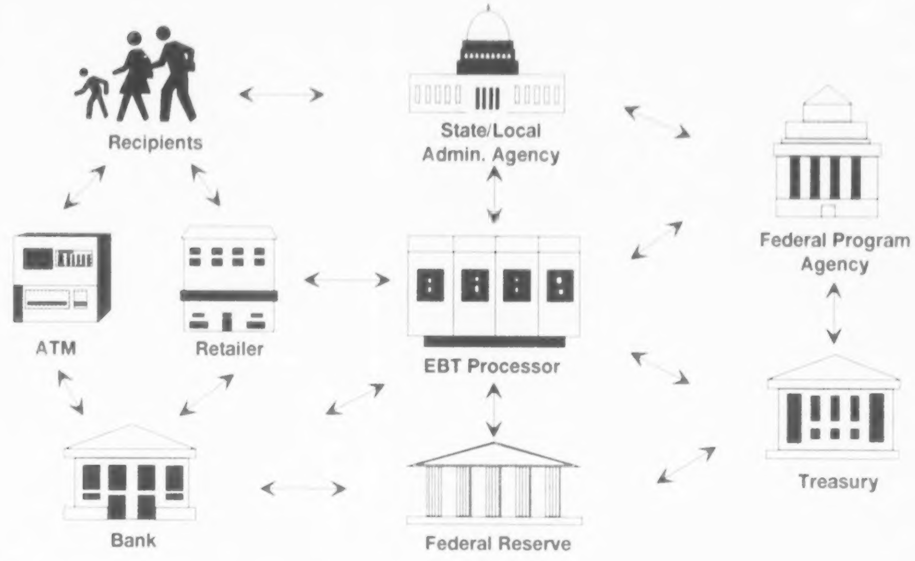
On the way home, Mark stops at his local pharmacy to refill a prescription. He rummages again through his wallet full of benefit cards and finds the Medicare Card that he needs to obtain and pay for medical and pharmaceutical services. However, Mark forgets his Medicare Personal Identification Number (PIN) and tells the clerk that "having to carry so many different cards with different PINs makes keeping track of your PINs very confusing." He is unable to have his prescription filled. Tired and frustrated, Mark wonders why the government has made it so difficult for him to obtain the services to which he is entitled.

What Is Electronic Benefits Transfer?

Electronic Benefits Transfer (EBT) uses automated financial transaction processing and card access technologies to electronically deliver Federal and State benefits to recipients. Recipients can access their benefits by using a card to transact with Automated Teller Machines (ATMs) operated by banks and Point of Sale (POS) terminals at retail locations. EBT systems issue and redeem benefits by using electronic networks to transfer benefits from a public assistance account to a retailer's account (see figure 4-1). An EBT system can be designed to accept magnetic stripe cards and/or "smart cards"—a card the size of a credit card with an embedded integrated circuit that contains memory and performs processing functions (see ch. 2 for discussion of EBT technologies). EBT eliminates the use of paper coupons and checks, together with the distribution, processing, collecting, sorting, and much of the accounting work. EBT is piggybacking, to the extent possible, on the existing commercial infrastructure for banking and credit-card servicing. EBT is intended to streamline the process by which government benefits are issued, spent, and redeemed. EBT systems eventually will include eligibility determination and certification, as well as benefits transfer.

The U.S. Department of Agriculture's (USDA's) Food and Nutrition Service (FNS), the U.S. Treasury's Financial Management Service (FMS), and other agencies are exploring the feasibility of a regional or nationwide EBT system for delivering food stamp and other benefits. FNS is sponsoring several pilot and operational tests of EBT for food stamps and the Special Supplemental Food Program for Women, Infants, and Chil-

Figure 4-1—Participants in Electronic Benefits Transfer (EBT)



KEY: ATM=Automated Teller Machine

SOURCE: Phoenix Planning & Evaluation, Ltd., "Multi-Program Cards for the Delivery of Social Services," contractor report prepared for the Office of Technology Assessment, Jan. 19, 1993.

dren (WIC).[1] Some current EBT projects provide benefits for multiple programs. Today, 37 of the 50 States are involved in or planning an EBT project (see table 4-1).

The opportunity to use card technology, computers, and telecommunications for EBT is here. Numerous Federal and State Government programs are suitable for EBT: food stamps; WIC; Aid to Families with Dependent Children (AFDC); Supplemental Security Income (SSI); Medicare/Medicaid; child support payments; General Assistance; job training assistance; educational grants or loans; and others. Pilot tests and evaluations indicate that EBT: 1) is well received and actually preferred by recipients, retailers, and providers at all levels; 2) speeds up the settlement of accounts for participating financial institutions and retailers (and can yield significant monetary savings to large-volume retailers);[2] 3) holds promise for reducing the levels of waste, fraud, and abuse associated with the coupon-based system (EBT, however, is not a panacea for the

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[1] For evaluations of completed pilot projects, see John A Kirlin, Christopher Logan, Mark Menne, Elizabeth Davis, Alicia Distler, and Stephanie Andrews, "The Impacts of State-Initiated EBT Demonstrations on the Food Stamp Program," Abt Associates, Cambridge, MA, June 1993; and Michele Ciurea, Christopher Logan, Mark Menne, and John Kirlin, "The State-Initiated Demonstrations: Their Design, Development, and Implementation," Abt Associates, Cambridge, MA, June 1993. Also see National Performance Review Accompanying Report, *Reengineering Through Information Technology* (Washington, DC: U.S. Government Printing Office, September 1993).

[2] For a complete discussion of the impact of commercial POS systems on food retailers, see Phoenix Planning & Evaluation, Ltd., "The Business Case for Retail POS," contractor report prepared for the Electronic Funds Transfer Association, December 1991. Also see Phoenix Planning & Evaluation, Ltd., "Report on the Development of EBT Financial Infrastructure Models," contractor report prepared for the U.S. Department of Agriculture, December 1992. Speeding up settlements, however, would reduce the Federal Government's float. According to FNS, "float" is a measure of earning power gained or lost through the ability of funds to earn interest in a bank account. See U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis and Evaluation, "Electronic Benefit Transfer in the Food Stamp Program: The First Decade," March 1992, p. 13.

Box 4-A—Food Stamps Today: A Paper-Based System

The Food Stamp Program (FSP), administered by the U.S. Department of Agriculture's Food and Nutrition Service (FNS) in cooperation with the States, spends roughly $25 billion annually, and serves about 11 million households (perhaps 27 million individuals). FSP prints more than 375 million food stamp booklets per year, including 2.5 billion paper coupons. Participating retailers accept these coupons in lieu of cash for the purchase of groceries. Retailers deposit the coupons at their local banks for credit to retailer accounts.

The use of paper coupons and other paper documents makes issuance and redemption of food stamp benefits a cumbersome process for all involved. A typical food stamp transaction using paper coupons includes the following steps:

- coupons are printed, stored, and shipped under tight (cash equivalent) security;
- recipients use the coupons to purchase eligible food items;
- cashiers determine whether the items meet program criteria;
- after accepting the coupons for purchased food, the retailers store, count, and endorse the coupons;
- retailers then fill out redemption certificates and deposit them and the coupons at their financial institutions;
- the financial institution then counts the coupons, verifies the totals against the amounts listed on the redemption certificates, fills out Food Coupon Deposit Documents, credits the merchant, and submits the coupons and paperwork to the Federal Reserve Bank;
- the Federal Reserve Bank, in turn, confirms the totals, checks for counterfeit coupons, destroys the coupons, credits the sending institution's account, and debits the U.S. Treasury account; and
- FNS monitors and reconciles the flow of paper and benefits through numerous reports provided by participating retailers, State agencies, and the Federal Reserve Bank.

FSP is expensive and difficult to administer, and generates an immense volume of paperwork. The paper-based system requires complex procedures intended to prevent coupon losses and to track and reconcile the flow of food stamp benefits through the system. Waste, fraud, overpayments, and participant misuse are considered to be major problems in FSP. Food stamp fraud and overpayments are estimated to be more than $1 billion per year. Improving the integrity of FSP was one of the major motivations in early exploration of electronic benefits transfer (EBT) for food stamp delivery.

The present system for authorizing, issuing, and redeeming food stamps imposes other costs on program recipients, retailers, and financial institutions. Recipients frequently must make a special trip each month to obtain their coupons. If a recipient loses his or her coupons after issuance, the benefits are not replaced. Retailers and financial institutions need to use special procedures to handle and process the coupons as an alternative form of currency.

SOURCE: Office of Technology Assessment, 1993; and the Food and Nutrition Service, U.S. Department of Agriculture.

"elimination" of fraud and abuse);[3] and 4) provides services to recipients in a more convenient and cost-effective manner.

See box 4-A for an example of paper-based benefit transfer of food stamps and box 4-B for a description of an EBT pilot project to deliver WIC benefits.

Electronic service delivery using EBT may ultimately yield significant cost savings in program administration by streamlining the enrollment and

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[3] See ch. 7 and U.S. Congress, Office of Technology Assessment, *Electronic Delivery of Public Assistance Benefits: Technology Options and Policy Issues*, OTA-BP-CIT-47 (Washington, DC: U.S. Government Printing Office, April 1988). Electronic identification methods, such as computerized fingerprint identification combined with card technology, could provide enhanced security. See, for example, U.S. Congress, Office of Technology Assessment *The FBI Fingerprint Identification Automation Program: Issues and Options*, OTA-BP-TCT-84 (Washington, DC: U.S. Government Printing Office, November 1991).

Table 4-1—EBT Project Status for the Food Stamp Program by State

State	EBT Project Status
Alabama	Preparing a Planning APD to seek approval to begin planning.
Arkansas	Passed legislation (1/93) mandating a pilot system.
California	San Bernardino Co.--FNS and ACF provided comments on Planning APD and RFP. County may withdraw proposal because of FSP regulation on cost neutrality.
Colorado	Internal State exploration of EBT.
Delaware	Preparing concept paper incorporating a proposal to pilot off-line EBT for FSP, WIC, and other programs.
Florida	FNS provided comments on Planning APD for joint FSP/AFDC system. State response pending.
Georgia	Submitted Planning APD for an integrated FSP/AFDC project in two counties. Legislature passed resolution in support of EBT.
Hawaii	Internal State exploration of EBT.
Illinois	Planning APD contingently approved by FNS and ACF. Planning a pilot project in a rural site and an urban site.
Iowa	Operating a voluntary EBT system in Linn County issuing AFDC benefits. Plan approved to add 4,100 FSP households.
Kansas	Given conditional approval of Planning APD to begin activities for a multi-benefit EBT system for FSP, AFDC, and Medicaid benefits.
Maine	Received approval in 1992 for a tri-state EBT system with New Hampshire and Vermont.
Maryland	EBT system now statewide for FSP, AFDC, GA, and CSE. Will serve over 138,000 FSP households and include about 3,400 food retailers.
Massachusetts	Expected to submit Planning APD for a project in the near future.
Michigan	Contingent approval from ACF in 1992 to develop a multi-benefit EBT system for FSP, AFDC, Medicaid, WIC, and other assistance programs.
Minnesota	Ramsey County has on-line EBT for FSP and assistance programs. Looking into expanding to neighboring county.
Mississippi	Legislated on-line and off-line EBT pilot projects. Submitted Planning APD to FNS to begin an FSP pilot project.
Missouri	Submitted a revised Planning APD for an EBT system for FSP, AFDC, WIC, and Medicaid.

disbursement processes. The projected startup costs could be an obstacle to a nationwide EBT system. But the decreasing cost of technology, combined with cost-sharing strategies among government agencies and the private sector and cost savings from administrative streamlining, could make a national EBT system cost effective. EBT offers, in addition, the potential to improve the quality and integrity of many Federal and State benefit programs.

How EBT Works

EBT could be implemented as an on-line, off-line, or hybrid system. In an on-line EBT system, the recipient is issued a plastic magnetic stripe EBT access card similar to a retail debit card. The recipient uses the card to access cash benefits at an ATM, and purchases items paid for electronically at a POS terminal. The recipient inserts the card into or swipes it through the POS terminal and keys in his or her Personal Identification Number (PIN). The amount of the benefits to be drawn is keyed into the terminal, and an electronic message is sent to an EBT processor. The EBT processor verifies that sufficient funds exist in the account and returns an on-line authorization message to the inquirer.

The authorization data travel from the POS system to the central database or EBT processor and back over the public switched network. Once

State	EBT Project Status
New Hampshire	Received approval in 1992 for a tri-state EBT system with Vermont and Maine.
New Jersey	Demonstration project under way. Proposed a pilot site to serve FSP and AFDC cases in three counties.
New Mexico	Implemented EBT in 1990 in Bernalillo County for FSP and AFDC. Submitted proposal to FNS to expand statewide.
New York	Internal State exploration of EBT.
North Carolina	Conducting early planning activities.
North Dakota/ South Dakota	Jointly submitted a Planning APD for a two-State EBT project for FSP. States plan to release an RFP by December 1993.
Ohio	Off-line FSP pilot project under way in the Dayton area. Legislation passed by the State and funding authorized for a statewide multiple-benefit EBT program.
Oklahoma	Submitted a Planning APD to develop and operate an EBT system for FSP. Plans to add AFDC and child support payments later.
Oregon	EBT task force formed. Planning APD submitted and approved, contingent on satisfactory response to a number of concerns.
Pennsylvania	Reading now serving 8,000 FSP households. Other counties and AFDC will be added. PA Department of Public Welfare developing APD proposing procurement of a new multi-benefit EBT system.
South Carolina	Plan approved for large on-line system for FSP. Will eventually serve approximately 120,000 FSP households.
Tennessee	Internal State exploration of EBT.
Texas	Submitted a preliminary Planning APD to FNS for a multi-benefit EBT system.
Utah	Submitted a Planning APD for FNS approval.
Vermont	Received approval in 1992 for a tri-state EBT system with Maine and New Hampshire.
Virginia	Internal State exploration of EBT.
Wisconsin	Internal State exploration of EBT.
Wyoming	Off-line operations for WIC begin in Casper area 5/91. Will expand for WIC and add other programs, including FSP.

KEY: ACF=Administration for Children and Families; AFDC=Aid to Families With Dependent Children; APD=Advanced Planning Document; CSE=Child Support Enforcement; EBT=Electronic Benefits Transfer; FNS=Food and Nutrition Service; FSP=Food Stamp Program; GA=General Assistance; RFP=Request for Proposals; WIC=Special Supplemental Food Program for Women, Infants and Children.

SOURCE: Office of Technology Assessment, 1993, based on information provided by the Food and Nutrition Service.

the purchase is authorized, the purchase amount is debited from the recipient's account and credited to the retailer's system account. At the end of the day, a financial settlement takes place. Funds are then transferred electronically from the U.S. Treasury's bank account to retailers' depository accounts via the Automated Clearing House (ACH). When benefits are issued and redeemed through an EBT system, the need to print, store, issue, and redeem paper records or coupons is eliminated. Also, the transaction is for an exact amount, eliminating the need for cash change and minimizing the diversion of program benefits.

The United States already has a commercial infrastructure in place for supporting on-line transactions. And retailers are investing in on-line POS terminals for commercial debit/credit transactions. These systems, with minor modifications, also can accommodate EBT transactions.

In an off-line or smart card system, the recipient's account balance is maintained on the card itself. The card has an integrated circuit with a microprocessor that stores the information necessary for verification, uploading benefits, monitoring benefits remaining on an account, and deducting the purchase amount from the card itself.[4]

A typical off-line transaction at a retail store works as follows. The recipient inserts the card into a POS device that is customized for smart card applications (smart cards, unlike magnetic stripe cards, cannot be used with the existing base of on-line POS terminals).[5] The recipient enters a PIN. The amount of the purchase is keyed into the terminal. If sufficient funds remain on the card to cover the purchase, the transaction is processed and the purchase amount is deducted from the balance carried on the card. The off-line transaction requires no immediate telecommunications link to a host computer for verifying the account and checking the balance. The completed transactions are captured on smart card-compatible POS terminals and transmitted in batches to the host computer of the EBT processor or government agency. A backup copy of each recipient's account is maintained and updated at the host computer. A telecommunications link is only needed for a periodic, scheduled call between the retailer and the host computer database, which electronically gathers the transactions and transfers the total transaction amount directly to the retailer's bank account through the ACH.

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[4] For an in-depth discussion of smart card technology and applications, see Jerome Svigals, *Smart Cards: The New Bank Cards* (New York, NY: Macmillan Publishing Co., 1987).

Drawbacks to using smart cards for EBT include the:

1. high cost of the smart cards—the cost will drop with time and when purchased in bulk, but is still considerably higher than magnetic stripe cards;[6]
2. lack of compatibility between off-line technology and the existing commercial infrastructure, and the resultant need to retrofit ATM and POS terminals to accept smart cards;
3. lack of uniform technical standards for programming card-based computer chips (the memory and processor within the smart card);[7] and
4. continued, although reduced, need for some form of on-line communication with the EBT processor.

A Dayton, Ohio pilot project is testing the feasibility of using an off-line EBT system for food stamp delivery. The project started in 1992 and is being evaluated, with results expected in late 1993.[8] A Wyoming pilot project tested off-line EBT for WIC delivery (see box 4-B); this project is being expanded to include food stamps.

A hybrid EBT system would use POS terminals that accept both smart cards and magnetic stripe cards, and would use smart cards that have a magnetic stripe on the back. A hybrid system would, for example, allow food stamp and WIC applications to be processed off-line and the cash programs (e.g., AFDC) to be provided on-line.

Hybrid POS terminals that accept magnetic stripe and smart cards are already on the market. Hybrid terminal manufacturers expect the cost of hybrid terminals to be in the $500 range when purchased in batches of 10,000 units. Existing on-line POS terminals can be retrofitted (also at $500 each); however, it may be prudent to replace older POS magnetic stripe terminals with new hybrid terminals. ATMs can be retrofitted to handle both smart and magnetic stripe cards at a cost of $2,500 per terminal. The entire ATM infrastructure in the United States could be retrofitted at a cost of roughly $225 million (90,000 ATM terminals at $2,500 each).

ALTERNATIVES FOR IMPLEMENTING A NATIONAL EBT SYSTEM

Technical and Administrative Issues

Decisions on EBT system design and development will affect the integration of EBT with the

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[5] POS terminals can be retrofitted to accept smart cards. See later discussion.

[6] Industry sources note that the cost of smart cards has been dropping at a rate of 15 percent per year. The cost of purchasing a smart card with three kilobits of memory (sufficient to handle food stamps and WIC applications) is in the range of $3.50 to $6 per card in large batches of several million cards. Prices will drop further as the technology continues to evolve and when two proprietary patents expire in 1995–96.

[7] Government/private sector committees are working to develop appropriate standards.

[8] The Ohio State Legislature (with the support of the Governor) passed legislation that authorizes funding for expanding the EBT pilot in selected major metropolitan areas by July 1995. The State of Ohio is awaiting approval from USDA.

Box 4-B—The Case of WyoCard: A Smart Card Success

Early in 1990, the State of Wyoming began to consider using EBT to deliver WIC, AFDC, food stamp, and Medicaid benefits. The State subsequently designed and developed a pilot program to test EBT—initially for the delivery of WIC benefits.

WIC is a grant program administered by the USDA Food and Nutrition Service. Its goal is to provide supplemental food and nutritional education to: 1) low-income pregnant, postpartum, and breast-feeding women; 2) infants; and 3) young children up to 5 years of age who are considered to be at nutritional risk. WIC is a cost-effective Federal program. For every dollar spent on prenatal WIC, the estimated cost savings to Medicaid is roughly $3 to $4 for every newborn child in just the first 60 days.[a]

In the WIC test, the WyoCard—a smart card—was used as a substitute for paper vouchers. WyoCard users visited a nutrition counseling center every 2 months, per usual procedures. But instead of receiving paper checks with dollar amounts and approved food items printed on the checks, the dollar and product information was electronically encoded on the smart card. WIC recipients could then use the cards in lieu of checks when shopping at participating food retailers.

Wyoming's WyoCard pilot began operations in May 1991 in Natrona County (Casper area). WyoCard used off-line smart card technology, in part because of the sparsely populated and large geographic area and high telecommunications costs.

An OTA site visit and an independent evaluation of the Wyoming WIC pilot test found that:

1. WIC clients using the WyoCard reported that the card provides greater flexibility in shopping and is more convenient.
2. Clients believe that the WyoCard gives them a stronger sense of dignity.
3. Clients feel that their benefits are protected in the case of loss or theft.
4. Clients find that the card is more durable and easier to carry than coupons.
5. Participating retailers feel that substantial cost savings could be achieved using the WyoCard by reducing banking fees associated with coupons and account settlements.
6. Retailers found that the WyoCard frees cashiers from the responsibility of having to remember what items are WIC-eligible and what items are not.
7. Retailers think that, with some modification to the scanning mechanism, they can provide faster transactions for WIC clients and for the general public as well.
8. WIC staff responsible for the WyoCard program view the card as enhancing the counseling, enrollment, and benefit issuance aspects of the WIC program.
9. WIC staff expect that the WyoCard will result in a reduction in waste, fraud, and abuse that is typical in the paper coupon system.

The widely recognized success of the WyoCard pilot has led to other initiatives. Wyoming—with the support of the retailing, banking, and telecommunications industries—is expanding on the WyoCard initiative to include other social programs, like food stamps, on WyoCard. WyoCard is serving as a possible prototype for a regional EBT system and, potentially, a smart card "health passport."

[a] Based on USDA contractor estimates. See the Library of Congress, Congressional Research Service, "Special Supplemental Food Program for Women, Infants, and Children (WIC): A Fact Sheet," CRS Report 93-279 EPW, Mar. 4. 1993.

KEY: AFDC=Aid to Families With Dependent Children; EBT=electronic benefits transfer; USDA=U.S. Department of Agriculture; WIC=Special Supplemental Food Program for Women, Infants, and Children.

SOURCE: Office of Technology Assessment, 1993; and Alan D. Moore, "Final Evaluation Report, The Electronic Benefits Transfer Smartcard Pilot Demonstration in Casper, Wyoming," December 1991.

existing commercial ATM/POS networks. Startup and operating costs can be reduced by using the existing on-line commercial infrastructure (i.e., networks, terminals, and processing protocols) as much as possible. EBT telecommunications costs will be higher with on-line systems, but the government may be able to negotiate a discounted bulk rate from EBT processors and telecommunications vendors. Retailers and banks will be more supportive of EBT if it uses a standardized infrastructure.[9] Retailers may be more inclined to pay for advanced POS technology (e.g., hybrid terminals) towards the end of the life cycle of the presently installed base of POS equipment (the life cycle for POS terminals is between 5 to 7 years).

The integration of EBT with commercial POS and ATM networks is, thus, an important goal. An integrated system offers lower system development and implementation costs, lower system operating costs through processing efficiencies, the potential for providing better service to program recipients, and greater marketability of the system within the retail sector. In order to facilitate system integration, an EBT system would have to adopt design standards that are compatible with standards established in the private sector. This argues in favor of on-line magnetic stripe card-based EBT, or retrofitting the existing ATM/POS infrastructure to permit use of hybrid cards, at least until such time as commercial networks provide reasonable support for separate off-line smart card systems.

Four basic alternatives for implementing a national/regional EBT system include:[10]

1. State-Initiated Model,
2. State-Initiated Model With Federal Operating Rules,
3. Federal/State Partnerships, and
4. Federally Initiated Model.

State-Initiated Model

The States would initiate EBT implementation, with the Federal role limited to policy guidance on such matters as: a) the exchange of information and services across State lines; b) use of the system to access multiple-benefit programs through a single card; and c) allocation of funds and fees by program and State. In this model, all of the responsibility for designing, developing, and implementing EBT systems would rest with the States.

State-Initiated Model With Federal Operating Rules

The Federal Government would promulgate operating rules for the participating States. These rules could address: a) interstate processing and interchange; b) retailer/ATM liabilities and rights; c) pricing structures (not exact prices); d) methodologies for allocating funding and fees; e) recipient rights and responsibilities; and f) settlement procedures.

Federal/State Partnerships

The States would join with the Federal Government to create multiagency, multiprogram, and multi-State partnerships for selecting and implementing a national EBT system. The national system would service Federal direct benefit programs and State-administered benefit programs in each participating State. The operating rules and procedures (e.g., account settlement and allocation methodologies) could be negotiated and established by the partnerships. This approach likely would lead to regionally based EBT systems.

Federally Initiated Model

Here the Federal Government (in consultation with the States) would select a limited number of

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[9] A 1992 USDA study concluded that EBT system costs would be much higher if EBT does not use commercial ATM/POS networks, and that retailers would probably resist a new food stamp system that could not use the existing POS system. See U.S. Department of Agriculture, Food and Nutrition Service, op. cit., footnote 2.

[10] The conceptual framework for this discussion is based in part on Phoenix Planning & Evaluation, Ltd., "Multi-Program Cards for the Delivery of Social Services," contractor report prepared for the Office of Technology Assessment, December 1992, p. 48. See also John A. Kirlin, Charles R. King, Elizabeth E. Davis, Christopher Jones, and Gary P. Silverstein, "The Feasibility of a Nationwide EBT System for the Food Stamp Program," Abt Associates Inc., April 1990.

EBT processors from across the country in a competitive procurement. These processors would have the technical and financial capabilities to operate a large-scale EBT system, servicing both federally and State-administered benefit programs for participating States. States could elect to become members of this federally initiated EBT network.

The federally initiated model or Federal/State partnerships hold the most promise for reducing administrative expenses incurred by States in EBT development and implementation. They eliminate the need for States to develop their own unique systems and allow for a greater degree of standardization of the EBT infrastructure—an important element in achieving a cost-effective operation.[11]

In all four alternatives, the EBT system ideally should be designed to incorporate cash assistance programs (e.g., AFDC), as well as cash equivalent programs (e.g., food stamps and WIC), third-party payer programs (e.g., Medicare/Medicaid), and eligibility determination. All the alternatives will require extensive cooperation between State and Federal agencies. The Federal Government, State agencies, and commercial vendors could become partners in EBT, similar to the involvement of financial institutions, network operators, and retailers in Electronic Funds Transfer (EFT).

If current policy continues, States would have the right to decide whether or not to participate in an EBT system. Policymakers ultimately may, however, have to decide whether EBT participation should be mandatory, not voluntary, in order to make EBT cost effective and to realize other goals (e.g., reduction of fraud).

Cost Issues

Cost effectiveness is not assured with EBT. It depends on what costs and benefits are included and/or what development and implementation strategies are pursued. Cost effectiveness is crucial if EBT is to be a viable alternative to paper for delivery of benefits.

Despite numerous EBT feasibility studies and evaluations conducted to date, many important cost-related questions remain unanswered due to a lack of authoritative data and other uncertainties (e.g., what cost-sharing arrangements will be in place, if any) that affect cost projections. The issue of "who pays" is a complex policy question. New opportunities for cost-sharing and partnering between the Federal and State Governments and the private sector can help offset and defray some of the startup costs associated with EBT. The Federal and State Governments can leverage the rapid growth of commercial POS terminals in retail locations. POS systems used for commercial debit/credit transactions, as well as for EBT, tend to yield higher profit margins and a competitive advantage for retailers.

Most prior cost analyses have assumed that all costs associated with EBT system design, development, installation, and implementation would be borne by the Federal and State Governments. This need not be the case. Federal/State Governments could use, to the maximum extent possible, the private sector's POS/ATM infrastructure and provide supplemental equipment and EBT access only for geographic areas and recipients not otherwise served. Federal and State Governments could duplicate the model used by the State of Maryland to establish a statewide, multiple-program EBT system that combines a contractual and partnership relationship with the private sector (see box 4-C).

EBT costs include: 1) system design and development costs, 2) system implementation costs, and 3) operating costs.

System Design and Development Costs

In a State-initiated alternative, the State would be responsible for preparing planning documents and submitting them to each of the relevant Fed-

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[11] Standardization allows EBT recipients in one State to shop at stores in another State. It also promotes integration of multiple-State EBT systems with commercial interstate POS systems and ATM networks.

Box 4-C—The Case of Maryland: Statewide Electronic Benefits Transfer (EBT)

The original Maryland EBT pilot test began in November 1989 in Baltimore. Today, Maryland has the first statewide, operational EBT system in the Nation. The Maryland EBT system, using a magnetic stripe "Independence Card," provides electronic delivery of food stamps, Aid to Families with Dependent Children (AFDC), General Assistance, and Child Support payments. The State of Maryland incurred no startup cost in implementing the statewide EBT system, other than the expense of administering the procurement process. The State contracted on a competitive basis with a private vendor that is responsible for purchasing and installing terminals in all authorized retail outlets, purchasing and issuing cards, establishing and running a 24-hour customer service center, providing network and financial transaction services, and maintaining and updating client accounts. Implementation and operating costs are included in the contract price—currently $3.13 per month/per case for providing food stamp benefits electronically, and $1.00 per case/per month for AFDC.

SOURCE: Office of Technology Assessment, 1993.

eral program agencies for approval. This process usually takes many months and typically costs from $200,000 to $400,000 per State on average.[12]

To reduce costs, the Federal Government could design an EBT prototype(s) and procure the services of several EBT vendors (i.e., the federally initiated model). The vendors would then offer "core" EBT systems to States that, in turn, could purchase EBT services at, hopefully, competitive prices. This might reduce the cost of system design by 50 percent or more at both the State and Federal levels.[13]

States still could require some modifications to the "core" EBT systems to meet unique State needs. Even so, the approach could significantly reduce the vendor's costs of bidding for each State's business. Streamlining the process would not only cut direct procurement costs for vendors, States, and the Federal Government, but also could provide added impetus for vendors to offer discounted prices for the systems procured. The selection of system vendors and processors should, of course, be conducted through competitive bidding, with an emphasis on standardized and flexible EBT systems.

System Implementation Costs

POS-terminal installation (including equipment and site preparation) is the largest single expense item. At $300 per terminal installation, plus $500 for the terminal itself, cost estimates range from $120 million for 150,000 terminals to $480 million for 600,000 terminals. These estimates assume that EBT system vendors will be able to modify existing POS software rather than develop new software. The estimates assume that PINs are assigned by the vendors, which is less expensive, rather than selected by the recipients.

As of June 1991, 70,000 commercial POS systems were deployed in stores nationally.[14] Today, roughly 93,000 POS terminals are deployed, with about 41,000 in food stores and supermarkets.[15] Earlier EBT cost projections for food assistance programs assumed that terminals would be deployed in all checkout lanes of all participating stores, thereby requiring about 600,000 terminals. Recent estimates suggest that far fewer additional terminals may be needed. Reference Point Foundation concluded that FNS can still meet food stamp regulation requirements and provide EBT service nationwide with a deployment of about 300,000 POS terminals—a reduction of 300,000 terminals.[16] FNS officials now believe that even these numbers are outdated since commercial POS terminal deployment is growing rapidly.

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[12] Kirlin et al., op. cit., footnote 10. The cost for all 50 States would total $10 million to $20 million.

[13] Phoenix Planning & Evaluation, Ltd., "Multi-Program Cards for the Delivery of Social Services," op. cit., footnote 10, p. 38.

[14] U.S. Department of Agriculture, Food and Nutrition Service, op. cit., footnote 2, p. 2.

[15] Paul F. Coenen, President, Electronic Strategy Association, personal communication, May 1993.

Each 10 percent reduction in additional terminals would reduce implementation costs by another $24 million. Also, EBT vendors may be willing to assume a share of implementation costs, since vendors can amortize the purchase of POS terminals over several years and treat this as a monthly operating expense. For estimating purposes, OTA assumed that 150,000 additional terminals would be needed to meet the 300,000 level (90,000 existing terminals plus 60,000 expected through further private sector deployment, plus 150,000 additional terminals).

Another major cost element is the purchase of cards for eligible and participating recipients. The number of cards will depend on the number of programs included and the number of recipients per card. For estimating purposes, OTA assumed a multiprogram EBT card that covers food stamps, WIC, AFDC, general assistance, and SSI. These programs serve roughly 55 million persons,[17] but many participate in more than one benefit program. Adjusting for overlap (see table 4-2), about 45 million different persons receive food stamps, WIC, AFDC/general assistance, and/or SSI benefits. OTA assumed that cards would be issued only to adults, not children; thus OTA estimated the number of cards to be issued at 30 million (this allows some margin for replacement cards and growth in the number of recipients).

The card cost, therefore, would be about $15 million for magnetic stripe cards (assuming a cost of $0.50 per card) and roughly $105 million for smart or hybrid cards (assuming a cost of $3.50 per card). Use of hybrid or smart cards also would necessitate conversion or retrofitting of the existing POS and ATM infrastructure, at a cost of $45 million for the POS terminals ($500 per unit) and $225 million for the ATMs ($2,500 per unit for complete retrofit).

Another cost element is the initial training of recipients and personnel from participating retailers and banks, estimated at about $25 million. The total estimated implementation costs for a nationwide EBT system for the selected social services (assuming 30 million cards issued) are shown in table 4-3—$160 million for a magnetic stripe card system and $520 million for a hybrid or smart card system.

Table 4-2—Estimated Overlap in Government Benefits

Households receiving	And also receiving	Estimated percentage of overlap
AFDC and General Assistance	Food Stamps	85
SSI	Food Stamps	44
Food Stamps	AFDC and General Assistance	50
Food Stamps	SSI	23

KEY: AFDC=Aid to Families With Dependent Children; SSI=Supplemental Security Income

SOURCE: U.S. Congress, House of Representatives, Committee on Ways and Means, *Overview of Entitlement Programs—1992 Green Book*, Committee Print 102-44, May 15, 1992, p. 1611.

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[16] Reference Point Foundation, "Innovations for Federal Service: A Study of Innovative Technologies for Federal Government Services to Older Americans and Consumers," contractor report prepared for the Office of Technology Assessment, February 1993, p. 73.

[17] Assumes that 28 million persons receive food stamps, 6 million receive WIC, 16 million receive AFDC and general assistance, and 5 million receive SSI.

Table 4-3—Estimated Implementation Costs for a Nationwide EBT System

Type of EBT system	Estimated implementation costs ($ millions)
Magnetic Stripe Card System	
POS terminal deployment	$120
Magnetic stripe cards	15
Training	25
Total	$160
Hybrid or Smart Card System	
POS terminal deployment	$120
Hybrid or smart cards	105
POS conversion	45
ATM retrofit	225
Training	25
Total	$520

NOTE: Assumes 45 million participants in an EBT program that covers food stamps, WIC, AFDC, general assistance, and SSI; and 30 million cards issued. See text for further discussion.

KEY: AFDC=Aid to Families With Dependent Children; ATM=Automated Teller Machine; EBT=Electronic Benefits Transfer; POS=Point-of-Sale; SSI=Supplemental Security Income Program; WIC=Special Supplemental Food Program for Women, Infants and Children.

SOURCE: Office of Technology Assessment, 1993.

Early FNS cost projections of a joint food stamp/AFDC EBT system using magnetic stripe cards ranged from $233 million to $291 million.[18] Today, FNS cost projections for a multiprogram (i.e., food stamps, AFDC, WIC, SSI, and other benefits) national EBT system are still within the $200 million to $300 million range. However, these projections do not factor in an aggressive Federal Government pursuit of cost sharing/cost reduction strategies, nor do they account for the continued growth of POS terminal deployment by commercial retailers irrespective of EBT.

Operating Costs

The two largest operating costs are terminal amortization and transaction fees. These costs can be negotiated into a contract with an EBT processor who will bear the up-front capitalization of purchasing and installing terminals (see box 4-C). The processor includes the costs of transactions and the necessary hardware/software investments in the monthly case fees charged to the government.

Assuming a POS terminal replacement cost of $500 per unit and that a national EBT system requires 300,000 terminals, a $150 million investment would be necessary every 5 to 7 years (the life of a typical terminal). Amortized over 5 years, the annual terminal cost would be about $30 million. These estimates are at the high end and do not account for accelerated private sector terminal deployment for commercial purposes and/or cost-sharing by participating retailers and banks. For estimating costs, OTA assumed that the government would pay one-half, or $15 million per year.

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[18] Kirlin et al., op. cit., footnote 10, p. vii.

Also, in a fee-based EBT system, these operating costs would be covered in the monthly case fees.

Transaction fees are incurred when a recipient uses an EBT card at an ATM or POS terminal. OTA assumed typical transaction fees of about $0.10 for an on-line debit (or credit) transaction, $0.02 for an off-line debit transaction (since no telecommunications or central computer verification are required), and $0.50 for a cash transaction. For a multiprogram EBT system with 30 million active cards, and assuming 12 transactions per recipient per month, the estimated annual transaction costs are shown in table 4-4.

The illustrative transaction costs for a magnetic stripe card EBT system are roughly $1 billion per year, or about $2.75 per case per month—roughly equivalent or perhaps slightly lower than the average paper-based costs for the food stamp program alone. Transaction costs could be further reduced if the Federal Government negotiates fees lower than current commercial averages or if the number of allowable "free" monthly recipient transactions—especially cash transactions—were to be reduced.

The comparable estimated costs for a hybrid card system are about $200 million less per year. This suggests that the additional up-front cost of a hybrid card system would be recovered in about 2 years' worth of savings in transaction costs. Note that card replacement costs could be a significant offset.

The comparable costs of a "no cash" system—for any type of card—would be dramatically lower due to the elimination of cash transaction fees. The

Table 4-4—Estimated Annual Transaction Costs for a Multi-Program EBT System

Type of EBT system	Estimated annual transaction costs ($ millions)
Magnetic Stripe Card System	
On-line	
Debit transactions 8/month @ $0.10	$288
Cash transactions 4/month @ $0.50	720
Total	$1,008
Hybrid Card System	
On-line	
Debit transactions 1/month @ $0.10	$36
Off-line	
Debit transactions 7/month @ $0.02	50
Cash transactions 4/month @ $0.50	720
Total	$806
Magnetic Stripe (No Cash) System	
On-line debit transactions 12/month @ $0.10	$432
Smart or Hybrid Card (No Cash) System	
On-line debit transactions 1/month @ $0.10	$36
Off-line debit transactions 11/month @ $0.02	80
Total	$116

NOTE: Assumes 45 million participants in an EBT program that covers food stamps, WIC, AFDC, general asistance, and SSI; and 30 million cards issued. See text for further discussion.

KEY: AFDC=Aid to Families With Dependent Children; EBT=Electronic Benefits Transfer; SSI=Supplemental Security Income Program; WIC=Special Supplemental Food Program for Women, Infants and Children.

SOURCE: Office of Technology Assessment, 1993.

estimated net additional annual savings would be over $500 million. A "no cash" system would necessitate widespread terminal deployment so recipients could make debit purchases at virtually all retail outlets. But most important, a "no cash" system would require recipients to adjust to a truly "cash-less, check-less" benefits program. This could be difficult.[19] The savings from a "no cash" system are so great, however, that substantial additional terminals could be deployed and a small paper-based system could be retained during a transition period and still show significant net cost advantages.

Another operating cost is training of new recipients and staff, and periodic refresher training for current recipients and staff, estimated at about $10 million per year.

Any EBT system is likely to reduce fraud and abuse. A national EBT system would, for example, reduce losses that take place through diversion of benefits when paper checks or coupons are used. Reduction in the levels of benefit diversion could offset some of the costs of a national EBT system, and, perhaps more importantly, improve the public's perception of the integrity of government programs. By eliminating cash change and reducing the opportunity for trafficking in benefits, a national EBT system might reduce levels of food stamp benefit diversion by as much as 80 percent. While this would not translate directly into savings in food stamp program costs, it would mean that more benefits are directed toward authorized food purchases. A national EBT system is likely to have some effect on net levels of food stamp benefit loss—currently about $0.09 per case month.[20] Elimination of these losses would reduce costs by more than $10 million per year, enough to, for example, offset a part of the annual amortization charge for POS-terminal deployment.

A national EBT system also could reduce overpayments to eligible recipients or payments to ineligible recipients—estimated at about 6 percent of total food stamp and AFDC benefit payments (roughly $2 billion to $3 billion per year) and about 4 percent of total SSI benefit payments (roughly $1 billion per year). The actual reduction would depend on whether and how EBT includes improved initial and continuing eligibility determinations. Even a partial reduction in overpayments would offset a significant part of the costs of EBT implementation and operations and/or some increase in the number of eligible benefit recipients.

EBT is very likely to be cost effective for participating retailers and financial institutions.[21] In order for EBT to be cost effective for the Federal Government, however, the cost of the current paper-based system would have to be reduced by an amount greater than the EBT cost—all factors considered. This could necessitate significant reductions in the current Federal/State staffing and bureaucracy that administers these benefit programs.

EBT POLICY ISSUES AND OPTIONS

A national EBT system is technically feasible and offers significant potential advantages to recipients, providers, funding agencies, and, ultimately, the U.S. taxpayers. EBT pilot projects, demonstrations, and evaluation studies lay the groundwork for making decisions on the transition to a national EBT system.

Key policy issues include: 1) selecting a program mix for EBT delivery, 2) revising Federal policies relevant to a national EBT system, 3) selecting a national EBT system alternative, 4) mandating a nationwide EBT feasibility test, and

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[19] A large percentage of food stamp, WIC, and AFDC recipients do not have bank accounts, and may not have any other way to readily obtain cash.

[20] John A. Kirlin, Christopher W. Logan, Mark G. Menne, Elizabeth E. Davis, and Kit R. Van Stelle, "The Impacts of the State-Operated Electronic Benefit Transfer System in Reading, Pennsylvania," Abt Associates, Cambridge, MA, February 1990, p. v.

[21] EBT pilot-test results suggest that retailers can cut their costs by 25 percent or more, and banks by 95 percent or more. See Kirlin et al., op. cit., footnote 1, p. v; Ciurea et al., op. cit., footnote 1.

5) providing coordinated legislative/executive leadership on EBT.

Selecting a Program Mix for EBT Delivery

EBT pilot tests and evaluation studies indicate that implementing a national EBT system for a single benefit program would not be as cost effective as a multiple-program strategy. Decisions are needed on what benefit programs should be combined for electronic delivery using the same card, terminals, and networks. Food stamps and AFDC, for example, are good candidates for combined delivery, given the significant overlap among recipients of these benefits and since both programs are State administered (see table 4-2). Pilot tests suggest that combining AFDC and food stamps on one EBT card reduces operating and delivery costs for both programs.

Selecting the optimal program mix would require negotiation between (and among) Federal and State agencies. A Federal/State partnership could be used to build a consensus on program mix and system integration. Alternatively, a lead Federal agency or an interagency "Electronic Payments Board" could act on behalf of the Federal Government in negotiations with States.

A multiple-program EBT approach is more likely to gain the support of State governments since this would spread costs over more programs, improving the cost effectiveness for each individual program. But multiple-program EBT presents challenges that would need to be addressed in the system design and in related legislation. Operating rules and regulations for a national EBT system would need to include procedures for account funding, the pooling of administrative costs, and governmentwide cost-sharing.

Once an appropriate program mix is identified, Congress could enact legislation that mandates the creation and use of a multiprogram Federal Social Service Card or the equivalent. Legislation and/or regulations would need to cover a variety of specific needs; for example, how to ensure that authorized retail outlets will provide benefits to recipients living in areas that are underserved by the existing ATM/POS infrastructure. A multiple-program EBT system may require some reorganization of Federal agencies responsible for administering social services, or the designation of an authorized Federal official or lead Federal agency with governmentwide jurisdiction over EBT. Multiple-program EBT can help Federal agencies rethink how they are delivering services.

PHOTOS: FRED B WOOD

Top: *The WyoCard project uses a smart card—a debit card with a computer chip—for issuing and redeeming Supplemental Program for Women, Infants, and Children (WIC) benefits. Recipients use the smart card instead of paper coupons when purchasing pre-approved food at participating grocery stores in Casper, Wyoming.*

Bottom: *The WyoCard and a typical card scanner, printer, and display terminal—similar in appearance to those used for standard credit and debit cards.*

Revising Federal Policies Relevant to a National EBT System

In order to accelerate the development and implementation of a nationwide EBT system, Congress and the President could start now to identify policies and regulations that may need revision. Ideally, a package of needed policy changes would be ready for consideration at the time further preoperational feasibility studies are complete. First, program-specific rules and regulations should be evaluated and revised to streamline the delivery process.[22] Second, Federal laws that protect the privacy and security of information about participants should be reviewed and revised as needed. Third, Federal and State banking laws should be re-examined in the context of EBT. A national EBT system must operate within the existing or revised Federal and State banking and financial policy framework.

To facilitate a national EBT system, Federal policymakers could:

1. Revise the Food, Agriculture, Conservation, and Trade Act of 1990[23]—The Act states that EBT is an acceptable operational alternative to paper-based food stamp coupons, and authorizes the Secretary of Agriculture to conduct demonstration projects, such as EBT pilot tests. The Food Act and the Omnibus Budget and Reconciliation Act require that food retailers incur no cost when purchasing and installing an EBT system for food stamp delivery.[24] This language serves as a disincentive for private sector participation in EBT. The language could be revised to permit or require private sector cost-sharing for EBT, or perhaps the provision could be deleted entirely. The Federal Government could be defined as a POS terminal-deployer of last resort rather than first resort.[25] The Food Act also mandates that the EBT system be cost neutral for the FSP and State agencies. This provision could be modified to permit or require Federal and State agency cost-sharing.
2. Develop interagency EBT regulations—The Secretaries of the Federal departments participating in EBT would need to develop a single set of regulations on technical standards, cost effectiveness, financial accountability, recipient protection, and system operations and performance, among other topics. This task could be assigned to an Electronic Payments Board, or some other interagency entity with high-level representation from participating Federal agencies.[26]
3. Review the applicability of the Privacy Act of 1974[27] to EBT—the Office of Management and Budget (OMB), participating Federal agencies, and EBT system developers and processors would need to review the Privacy Act, and identify revisions needed to ensure the confidentiality of personal information in EBT systems.
4. Review the applicability of the Computer Security Act of 1987[28] to EBT—OMB, the National Institute of Standards and Technology, participating agencies, and EBT providers likewise would need to review the Computer Security Act, and identify revisions to help assure the integrity and security of a national EBT system.

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[22] U.S. Department of Agriculture, Food and Nutrition Service, op. cit., footnote 1, p. 23. According to FNS, "streamlined procedures are needed for large-scale implementation."

[23] The Food, Agriculture, Conservation, and Trade Act of 1990, Public Law 101-624, Title XVII—Food Stamp and Related Provisions (cited as the Mickey Leland Memorial Domestic Hunger Relief Act, sec. 1729).

[24] The Omnibus Budget and Reconciliation Act, Public Law 97-253.

[25] One possible exception is for small retail stores that cannot justify investing in an EBT system.

[26] In April 1992, the USDA issued a set of requirements to be met by States wishing to participate in EBT for the FSP.

[27] The Privacy Act of 1974, Public Law 93-579. Also see ch. 7 and Office of Technology Assessment, *Electronic Delivery of Public Assistance Benefits*, op. cit., footnote 3.

[28] The Computer Security Act of 1987, Public Law 100-235. Also see ch. 7.

5. Revise Federal and State banking laws—OMB, the Department of the Treasury, and Federal and State bank regulators would need to review the banking laws for possible revisions. The Federal Reserve Board, for example, is reviewing and likely will extend Regulation E (which establishes debit card and EFT liabilities, and grievance procedures when a card is misused, lost, or stolen) to cover EBT as well.[29]
6. Review the applicability of the Cash Management Improvement Act of 1990[30] to EBT—OMB and the Department of the Treasury would need to review the act when considering EBT operating rules and procedures that affect the transfer of Federal payments and the "float" of Federal program funds.

Selecting a National EBT System Alternative

A basic issue is whether Federal agencies should take the lead in designing an EBT system, presumably still working with the States, or should essentially leave system design up to individual States. A federally initiated system may prove to be the most advantageous approach for two reasons. First, most States are pressed for financial resources, and a Federal lead on EBT design should reduce EBT planning and design costs for the States individually and the Nation as a whole. A Federal design approach offers cost savings to States and to EBT system developers by reducing the paperwork and labor involved in preparing and submitting multiple planning, design, and procurement documents to the numerous Federal and State agencies. Second, a federally initiated design presumably would place a premium on a standardized and interoperable system that maximizes opportunities for economies of scale and scope in EBT procurement and service delivery. A key to success, though, would be meaningful State participation in the Federal design process.

The Tulare Touch

FRED B. WOOD

Tulare Touch is a touchscreen kiosk used for processing applications for general assistance in Tulare County, California. EBT systems eventually will include the use of kiosks for eligibility determination.

EBT pilot programs at present are using multiple, decentralized designs. This is entirely appropriate at the pilot test and demonstration stage. But if continued into the pre-operational and operational stages, the effect of a multiple, decentralized design strategy would be to create several separate and segregated EBT systems. If the U.S. Government decided to implement a nationwide multiprogram EBT system, then a decentralized approach with Federal design standards would be better suited. This approach would:

1. encourage EBT system developers to standardize their equipment and networks,
2. accommodate those States that prefer regional EBT systems,
3. build on the commercial infrastructure for POS and ATM transactions, and

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[29] The Board of Governors of the Federal Reserve System is expected to release their position on Regulation E in October 1993.

[30] The Cash Management Improvement Act of 1990, Public Law 101-453.

4. still provide the necessary economies of scale to make EBT cost effective.

A Federal/State partnership could be formalized to design, develop, and implement a "virtual" national EBT system that builds on State and regional EBT systems and the commercial POS/ATM infrastructure—all operating within Federal design and operating parameters developed with Federal, State, and private sector participation.

Mandating a Nationwide EBT Feasibility Test

To more fully evaluate specific EBT system alternatives, a multiple- program, scaled-up, regionally based, and nationally coordinated feasibility test should be designed and implemented. The test should be designed to take advantage of existing pilot tests and programs, and to test all three viable technological options (i.e., on-line, off-line, and hybrid) for multiple-program delivery.[31] The test should use a well-defined evaluation framework.

are Touch
Instructions

FRED B. WOOD

Tulare Touch is available in English or Spanish. Instructions are straightforward; on-site training and assistance are provided as needed.

Congress could conduct oversight and direct OMB, the Department of the Treasury, and relevant agencies to develop plans for such a test. At present, there are no Federal plans to conduct a feasibility test of a hybrid system. Congress could, if necessary, reprogram the funding of the Department of Health and Human Services and FNS to ensure that both agencies include hybrid technology in further EBT testing. A well-designed test would provide results that could be available within 12 to 18 months. A feasibility test should address:

1. the advantages and disadvantages of a centralized v. decentralized, on-line v. off-line, standardized (conforming to a predetermined design and operating rules) v. free-form EBT system;
2. the organizational changes that would be required at the Federal, State, and local levels in order to develop and operate a nationwide EBT system, including the optimal program and agency mix;
3. the cost of developing and operating a nationwide EBT system and possible cost-sharing strategies;
4. the degree to which a nationwide EBT system could be integrated with existing commercial POS/ATM networks;
5. the likely impact of a nationwide EBT system on recipients and providers;
6. the likely impact of a nationwide EBT system on the banking, retail, and financial industries; and
7. legislative and regulatory issues that must be addressed to implement a nationwide EBT system.

A multiprogram national EBT feasibility test should include an evaluation plan that covers: 1) technical performance, 2) operational performance, 3) quantitative benefits and costs of a nationwide EBT system, and 4) qualitative benefits and costs of a nationwide EBT system.

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[31] The FNS-sponsored Maryland project is noteworthy in that statewide roll-out of EBT was completed in April 1993. According to FNS, the total number of FSP households receiving their benefits electronically will increase from about 60,000 to 200,000 statewide. The Maryland project is also notable because it combines food stamps, AFDC, a part of Child Support Enforcement, and General Assistance into a single delivery system.

Providing Coordinated Legislative/ Executive Leadership on EBT

Leadership from Congress and the President is key to EBT success. Leadership actions could include:

1. holding coordinated congressional oversight hearings on EBT (e.g., by the Senate Committee on Governmental Affairs, Senate and House Committees on Banking, Senate and House Committees on Agriculture, House Committee on Government Operations) to develop a consolidated Federal position on EBT;
2. establishing a Federal/State Benefits Payment or Electronic Payment Board and/or Interagency Policy Committee to develop strategies for, and seek consensus on, designing and operating a national EBT system.
3. designating and empowering a lead executive agency or agencies with sufficient stature and authority to direct interagency EBT efforts and enforce decisions (e.g., the Office of the Vice President, the Financial Management Service in the Department of the Treasury, and/or the Office of Federal Financial Management or the Office of Information and Regulatory Affairs in OMB);
4. designating and empowering a Federal interagency committee on EBT (e.g., drawing from the Departments of Agriculture, Health and Human Services, Education, Labor, and the Treasury, among others);[32]
5. encouraging States to participate and provide leadership through organizations that represent State governments, such as the National Conference of State Legislatures and the National Governors Association;
6. encouraging nonprofit consumer advocacy groups to organize a "National EBT Committee" to assure that the rights and needs of recipients are accounted for; and
7. encouraging private sector EBT vendors to participate in the development of strategies for EBT cost-sharing between the public and private sectors.[33]

In the final analysis, a nationwide EBT system will depend, in large part, on the collective involvement of Federal agencies, States, small and large retailers, recipients, banks, and EBT vendors. Including all these groups in the policy formulation process should lead to greater coordination, cooperation, and consensus.

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[32] An Interagency Steering Committee on EBT, coordinated by the Department of the Treasury, has commissioned an assessment of the financial and infrastructure requirements for a nationwide EBT system, but the timeframe and the outcome are uncertain.

[33] For a discussion of public/private cost-sharing strategies, see Reference Point Foundation, op. cit., footnote 16, pp. 70–71.

Grassroots Partnering in Electronic Delivery

5

SUMMARY

The primary goal of electronic delivery is to improve the quality, accessibility, and cost effectiveness of Federal services for Americans. This goal is not likely to be realized unless service recipients are involved at all stages—from planning and pilot-testing to implementation and evaluation of electronic delivery.

OTA site visits found that citizens are interested—in principle—in helping to improve service delivery and receiving at least some services electronically. But most find it difficult to learn about opportunities to participate and many lack the necessary time, training, and/or equipment. These barriers can be overcome through outreach, education, and adequate funding. If "electronic service to the citizens" is to succeed, grassroots citizen involvement will be needed and must be part of Federal electronic delivery projects. A mandatory set-aside from project or agency budgets may be needed to assure adequate resources for citizen participation.

Grassroots involvement in electronic delivery also is important to assure that the substantial gap between the information "haves" and "have-nots" is reduced, not widened. The distribution of computer resources, for example, is heavily skewed toward the more affluent, educated segments of U.S. society. Rural and inner city residents, persons with disabilities, and senior citizens are among those who might gain—or lose—from electronic delivery. Citizens with special needs can be "winners," but only if they are active participants with sufficient technical and financial support.

The local community infrastructure—schools, libraries, senior centers, town halls—can play a highly leveraged role in electronic delivery, especially in rural and small-town America, inner cities, and for citizens with special needs. The local community can

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provide leadership and training for its residents, and can assure "points of access" for those citizens who do not want or cannot afford home delivery. Such community involvement also is a necessary component of all Federal electronic delivery projects.

Another key to successful electronic service delivery is forging strategic partnerships among Federal, State, and local governments; user groups; and, where appropriate, the private sector—commercial, not-for-profit, philanthropic, and voluntary organizations. Effective partnering requires a true commitment from Federal agencies and a good match between program objectives, service providers, users, technologies, and expertise. Stronger incentives for partnering are needed, including performance awards and matching grants. The establishment of a Corporation for Electronic Service Delivery, modeled after the Corporation for Public Broadcasting, would foster strategic partnerships.

The private commercial sector is an essential partner in electronic service delivery. Private vendors supply the telecommunications equipment and services, computers, and vast array of peripheral equipment and software needed for electronic delivery. Private companies also can serve as systems integrators for electronic delivery systems, add further value to government services, and independently market enhanced services. Private firms, on occasion, underwrite joint development projects and pilot tests with government agencies and user groups, or provide discounted or donated equipment and services. And private companies are themselves recipients of many Federal services; electronic delivery should present companies with opportunities for cost savings and innovation, as well as for research, market development, and direct sales.

GRASSROOTS CITIZEN INVOLVEMENT IN ELECTRONIC DELIVERY

To be effective, any Federal electronic service delivery program—whether demonstration, preoperational, or operational—must emphasize accessible, user-friendly, affordable delivery. Pilot tests suggest that appropriately scaled, off-the-shelf, proven technology geared to the needs of the users generally will work best. Grassroots innovators have been remarkably successful in providing electronic delivery on shoestring budgets, with minimal costs to agencies or recipients.[1] The Federal Government can learn from the grassroots experience, and avoid the tendency to design unnecessarily large, complex, and expensive technical solutions.

High complexity sometimes may be inevitable when expanding systems to a regional or national scale; but grassroots involvement will help ensure an appropriate and workable solution. Local people and organizations wish to be involved. This sentiment is widely expressed across the land, from small business entrepreneurs and community activists, to American Indians and Native Alaskans, to inner city leaders and students, to State and local government officials.[2] Their involvement likely would lead not only to better solutions, but to a greater sense of commitment and self-ownership in harnessing information technology to improve government at all levels of society.

To further ensure equitable access to electronic service delivery for rural, inner city, and local community residents, as well as disabled persons, Congress could require both a governmentwide review of current agency programs that provide funding for grassroots use of information technology, and a budget set-aside for "grass roots involvement." A fractional percentage of total agency budgets for information technology could be reserved for use by agency clients and service recipients at the local, grassroots level. Set-asides also could be allocated from agency programmatic budgets, or from some combination of both technology and programmatic budgets. An appropriate Federal agency[3] could be designated to conduct a governmentwide survey, and then funded from set-asides to administer a grassroots grants program. A portion of the Federal grants could be matched with contributions from State/local government or private sector funding sources—including commercial companies, educational institutions, and philanthropies.[4]

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[1] For two examples of successful grassroots innovation in electronic delivery, see Frank Odasz, Big Sky Telegraph, "Computer Conference on Electronic Service Delivery to Rural/Small Town America," contractor report prepared for the Office of Technology Assessment, Jan. 8, 1993; and T.M. Grundner, National Public Telecomputing Network, "The OTA/NPTN Teleforum Project: An Experiment with a Multi-City 'Electronic Town Hall,'" contractor report prepared for the Office of Technology Assessment, January 1993.

[2] See Office of Technology Assessment, "Montana/Wyoming Trip Report," "Alaska Trip Report," and "California Trip Report," Nov. 10, 1992; and results of two computer conferences sponsored by OTA reported in Odasz, ibid., and Grundner, ibid.

The key is to provide at least a base level of funding for electronic delivery activities. As a percentage of the governmentwide information technology budget, even just one-quarter of 1 percent—about $65 million—would make a big difference when used by local community, volunteer, consumer, and self-help groups. However it might be accomplished, the objective would be to empower grassroots users as active participants in the demonstrations and tests leading up to operational decisions—before it is too late to assure that user needs are accounted for and met. The need for a grassroots program was strongly supported by the results of OTA's field visits, computer conferences, contract research, and community forums.[5]

Information technology can facilitate citizen access to government. Two OTA-sponsored computer conferences (conducted by Big Sky Telegraph (BST) headquartered in Dillon, Montana, and the National Public Telecomputing Network (NPTN) headquartered in Cleveland, Ohio[6]) confirmed that the citizens who participated view electronic delivery as potentially empowering. But they expressed concern that many people might be denied effective access because they lacked the necessary equipment, training, and/or financial resources. Participants were skeptical of centralized, national solutions to citizen access, and preferred decentralized, locally controlled use of information technology.

The Big Sky Telegraph conference concluded that:

> . . . [C]itizens need opportunities to acquire the skills and concepts relating to how they might benefit from a national information infrastructure. Direct, individual citizen participation is potentially available through scalable low-end systems . . . Citizens want to have more of a feeling of understanding, connectivity, and control of events in Washington that affect their lives . . . Federal promotion of the creation of community systems and advocacy of their use should steer clear of mandating how they will and will not be used. Maximum national benefit is most likely to result if citizens are given the tools and training and tasked to demonstrate what innovations best meet their local needs.
>
> Involving citizens in information sharing and citizen teleliteracy training programs

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[3] "Service to the citizen" or "grassroots community involvement" offices could be located at the Office of Management and Budget and General Services Administration, perhaps with comparable offices at the National Science Foundation, National Telecommunications and Information Administration, and various mission agencies. These offices could help coordinate electronic delivery initiatives with other Federal programs that include grassroots involvement in some form. For example, H.R. 1757, the National Information Infrastructure Act of 1993, approved by the House on July 26, 1993, and S. 2 Title VI, the Information Technology Applications Act of 1993, reported out of committee on May 25, 1993, include funding for the involvement of local schools, libraries, and governments, among others, in computer networking projects. Also see Information Infrastructure Task Force, "The National Information Infrastructure: Agenda for Action," National Telecommunications and Information Administration, Washington, DC, Sept. 15, 1993.

[4] See later discussion of strategic partnering.

[5] See earlier discussion and Office of Technology Assessment, Montana/Wyoming; Alaska; Olympia/Seattle, Washington; and California Trip Reports, Nov. 10, 1992. See also Odasz, op. cit., footnote 1; Grundner, op. cit., footnote 1; and William H. Dutton, "Electronic Service Delivery and the Inner City: Community Workshop Summary," contractor report prepared for the Office of Technology Assessment, December 1992. Also see Steve Cisler, "Community Computer Networks: Building Electronic Greenbelts," Howard Rheingold (ed.), *Virtual Communities* (New York, NY: Addison-Wesley, forthcoming).

[6] See Odasz, op. cit., footnote 1, and Grundner, op. cit., footnote 1. About 35 persons participated in the Big Sky computer conference; about 250 persons participated in the NPTN conference.

> would create local experts, versed in the local culture, to mentor local citizens through their introduction to the new electronic systems . . . Opportunities for leveraging local innovation in service delivery . . . should be aggressively encouraged, rewarded, and publicized . . . Facilitating bottom-up innovations will create the diversity, and attention to local differences, that centralized planning cannot provide.[7]

The BST and NPTN experience to date has resulted in important knowledge and insights about grassroots computer networking with direct implications for electronic service delivery (see box 5-A). These findings are generally consistent with the results of other OTA-commissioned research.

The Environmental Protection Agency's (EPA's) Toxic Release Inventory (TRI) is illustrative. Congress included a "community right to know" provision in the Superfund Amendments and Reauthorization Act of 1986 that required facilities that manufacture, store, or use certain hazardous materials to report information on such activities to EPA. Congress required that EPA maintain this information in a database known as the TRI, and make this information available to the public in electronic form. The TRI experience to date indicates that:

- The Federal Government is often the only source from which grassroots groups with limited resources can obtain the information they need to effectively participate in policymaking.
- The right to know is meaningless without easy and affordable access—$25 per hour for on-line access or $50 per computer diskette is too expensive for many citizens.
- Not-for-profit community and philanthropic groups can play a key role in facilitating low-cost, user-friendly grassroots access (see box 5-B on RTK Net).
- Information needs to be available in flexible, easy-to-manipulate electronic formats that can meet a wide range of needs—citizens may use the same information in quite different ways from Federal and State regulatory officials or industry.
- Electronic formats make possible a wide range of analyses that provide new insights into program implementation and impacts—for example by cross-correlating TRI data with health and census data.
- Electronic access to regulatory information can help further the overall objectives of Federal programs—monitoring and reducing public exposure to hazardous substances in the case of TRI.[8]

Without grassroots initiatives such as BST, NPTN, and RTK Net—multiplied many times over—the gap between the information "haves" and "have-nots" likely will widen, and Federal electronic service delivery probably will fall well short of its potential. The gap is illustrated by the disparity in ownership of home computers—ranging from less than 5 percent of senior citizens or inner city residents, to 20 to 30 percent of middle-class homes, to upwards of 40 to 50 percent of homes in more affluent, high tech, or university communities.[9]

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[7] Odasz, op. cit., footnote 1, pp. 1, 24, 25, 36.

[8] For further discussion, see Susan G. Hadden and W. James Hadden, Jr., "Government Electronic Services and the Environment," contractor report prepared for the Office of Technology Assessment, November 1992.

[9] Senior citizens and inner-city residents frequently have at least one thing in common when it comes to computers—limited financial resources to buy PCs and pay for software and on-line time. The experience of SeniorNet (a computer conferencing network geared to senior citizen issues and programs) and the results of OTA's Los Angeles inner-city conference suggest that both senior and inner-city citizens can use computers much more than at present—given adequate facilitators and training, access to PCs, and free or very low-cost on-line time. For general discussion of equity considerations, see Ronald D. Doctor, "The National Information Infrastructure Social Equity Considerations," School of Library and Information Studies, University of Alabama at Tuscaloosa, Apr. 13, 1993; Richard Civille, "A Vision for Change: Civic Promise of the National Information Infrastructure," Center for Civic Networking, Washington, DC, draft policy agenda paper, July 1993; and U.S. Congress, Office of Technology Assessment, *Adult Literacy and New Technologies: Tools for a Lifetime*, OTA-SET-550 (Washington, DC: U.S. Government Printing Office, July 1993).

Box 5-A—Grassroots Computer Networking: Lessons Learned

OTA commissioned two grassroots computer networks to conduct computer conferences on the topic of electronic service delivery. Big Sky Telegraph (BST), headquartered in Dillon, MT, and the National Public Telecomputing Network (NPTN), headquartered in Cleveland, OH, conducted the conferences during late summer and fall 1992. Lessons learned include:

1. *The costs to users of grassroots computer networking can be minimized.* Almost any personal computer (PC) and modem will suffice; high-end, high-speed equipment is not necessary. On-line telecommunication charges can be reduced by copying messages to a PC and preparing responses with the telecommunications line turned off, and by using fractional rates and bulk purchase discounts. Use of equipment that transmits messages faster will reduce on-line charges further.
2. *Any local community can have a community computer bulletin board.* BST has, in effect, created six "Little Skys" where people can dial in with a local call—further reducing on-line costs. BST is a rural equivalent of the NPTN of "FreeNets." BST is a rural FreeNet. All you need is a PC, modem, telephone line, and inexpensive bulletin board software. And to further reduce costs, the "Little Sky" or "FreeNet" can dial up a host computer once a night at off-peak rates to copy or add bulletin board items.
3. *Community computer bulletin boards really extend a sense of community.* BST and NPTN, like CompuServe and Minitel, found that users participate as much for sociability as for content. Users seek a comfort level and degree of intimacy that is not always prevalent in the community-at-large. Computer conferencing also greatly reduces any biases due to sex, physique, disabilities, speaking ability, etc. It is a leveling technology in this sense.
4. *Community computer networks usually get only limited support from the established government and business community.* The BST and NPTN approach is low-cost and decentralized; the State and Federal bureaucracies tend to favor higher cost, more centralized, or at least more controllable, approaches. Plus the "not invented here" syndrome is evident. Each organization has a tendency to invent its own solution or approach.
5. *Grassroots computer network utilities like BST and NPTN can facilitate local access to national computer networks that might not be otherwise technically feasible or affordable.* If local residents find computer networks such as Internet expensive or difficult to access directly, computer utilities can provide low-cost, user-friendly connections.
6. *Grassroots computer conferencing works for children.* Children as young as the third grade can use computer conferencing to learn keyboarding, e-mail, and the concept of communicating among a group electronically (some first-graders can handle it).
7. *Grassroots computer conferencing has significant potential for government service delivery.* For example: a) agricultural extension services, b) small business assistance, c) international trade—global trade networks offer tremendous potential for locally based global entrepreneurial networking, d) Indian reservation services, especially for the Indian schools and hospitals, e) vocational education for displaced homemakers, f) job opportunities—potential for computerized catalogs of jobs and skill requirements, and g) public access to the legislative process.
8. *Training is essential to computer conferencing success.* It is important for first experiences to be positive in order to develop self-confidence. Help lines work, rather than forcing users to struggle through manuals. As confidence builds, users can do more themselves and handle more complex functions. Initially many people are not ready for searching databases; but eventually users will want to and can do searches.
9. *Federal programs largely miss the potential of grassroots computing.* The government does not have good mechanisms to support small, local innovators lacking a major institutional affiliation. Suggestions: mini-grants of up to $5,000 or so to local innovators; more flexibility in the National Science Foundation and other Federal grant programs to support individuals and small, grassroots organizations; inclusion of grassroots representatives on Federal advisory and peer review panels; technology showcases and demonstrations (e.g., fiber-to-the-school demonstrations in rural, economically disadvantaged areas).

SOURCE: Big Sky Telegraph, National Public Telecomputing Network, and Office of Technology Assessment, 1993.

Box 5-B—The RTK NET: Grassroots Access to the Toxic Release Inventory

The RTK Net ("Right To Know" Network) is operated by the Unison Institute and OMB Watch, and funded largely by foundation grants. RTK Net is intended to provide a less costly, more user-friendly way for citizens and others to electronically access the Environmental Protection Agency's (EPA's) Toxic Release Inventory (TRI) database. It also offers derivative databases, computer conferences, and bulletin boards on hazardous waste and related topics.

TRI data also are available on-line from the National Library of Medicine and on computer diskette from the National Technical Information Service. But grassroots users typically found these sources too expensive and/or too cumbersome, which led to creation of RTK Net.

During fiscal year 1992, RTK Net users included:

- 230 public interest group members,
- 87 business or industrial officials,
- 67 governmental staff (including 25 from EPA),
- 43 researchers,
- 34 members of the press, and
- 29 other individuals.

SOURCE: Susan G. Hadden and W. James Hadden, Jr., "Government Electronic Services and the Environment," contractor report prepared for the Office of Technology Assessment, November 1992.

MEETING DIVERSE CITIZEN NEEDS

Inner City Residents

Local involvement in planning for electronic delivery also would help ensure that the needs of minority groups in inner cities are met. Information technology is highly leveraged because computers have become very user-friendly, and special technical or software skills are no longer needed for many applications. Computers and software are increasingly available in multiple languages, thus opening up access to the millions of Americans who speak English as a second language. Several of the pilot kiosk programs, for example in California and Hawaii, have demonstrated that multilingual electronic service delivery works.[10]

OTA sponsored a community workshop at the University of Southern California to discuss electronic service delivery and the inner city.[11] Workshop participants included a cross-section of community activists, innovators, researchers, entrepreneurs, and government officials concerned with revitalization of distressed inner city areas such as South Central Los Angeles. Participants emphasized that the key to energizing inner city use of electronic technology is to find ways for the technology to be part of and controlled by inner city residents and organizations. The inner city needs to develop its own applications and a sense of ownership in the technology.

The inner city is generally perceived as technically deficient and consumer-oriented, not technically skilled and producer-oriented. The emphasis of Federal (and State/local) programs, grants, and loans, etc., needs to be shifted to developing local inner city expertise, innovation, and infrastructure. Otherwise the disparity between inner cities and more affluent suburbs will continue to widen because of the slower diffusion of information technology into distressed areas. Participants concluded that the inner city cannot afford not to have information technology, lest it fall further behind in education, social services, and economic development.

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[10] See William H. Dutton and K. Kendall Guthrie, "State and Local Government Innovations in Electronic Services: The Case in the Western and Northeastern United States," contractor report prepared for the Office of Technology Assessment, Dec. 12, 1991; and Office of Technology Assessment, "California Trip Report," op. cit., footnote 2.

[11] The Sept. 15, 1992, workshop was organized and conducted by the Annenberg School for Communication and the School of Public Administration at the University of Southern California. Professor William H. Dutton served as principal investigator. For further details on the workshop results, see Dutton, "Electronic Service Delivery and the Inner City," op. cit., footnote 5; and Office of Technology Assessment, "California Trip Report," op. cit., footnote 2.

The workshop results suggest that an inner city information technology development strategy to support electronic delivery needs to:

1. *Reinforce inner city community values about computers.* Some inner city communities currently may not place much value on information technology. Community "gatekeepers" are critical to community acceptance of the technology. Gatekeepers—formal and informal—provide links between the inner city and the broader outside community. Technology and service providers need to work with the community gatekeepers to legitimize the technology. Most of the ethnic and cultural groups in the Los Angeles area (e.g., Hispanic, African-American, American Indian, Korean, and Chinese, among others, participating in this workshop) have gatekeepers ready to help in this process.

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Community workshop members discuss how information technology and electronic service delivery can help the inner city. The workshop was held at the Annenberg School for Communication at the University of Southern California, and included participants with diverse ethnic and cultural backgrounds.

2. *Identify and support inner city innovators, especially small businesses and community activists.* Innovators need to be mobilized to work on information technology applications for the inner city. Many minority-owned small businesses are not technically proficient; they need help in getting up to speed to compete for high-tech work—work that inevitably depends on the skilled use of telecommunications and computer tools. Innovators among minority-owned small businesses should have a large role in controlling the development and deployment of information technology in the inner city, as should local community organizations. Several Los Angeles area community groups are trying a variety of technology-enhanced innovations for meeting inner city needs, but they too need help with training and funding.
3. *Focus on information technologies that are affordable and usable by the inner city community.* Videoconferencing, for example, may not be affordable or really needed right now, but bulletin boards and computer networking cost less, are easier to implement, and have a higher payoff. Experience to date suggests that community electronic bulletin boards are cheap, cost effective, readily available, and usable. Bulletin boards can provide interoperability among systems, since virtually anyone with a personal computer and modem using Ascii text can access bulletin boards.
4. *Learn how to use inner city community resources more effectively to support information technology.* The public schools, for example, typically have space available evenings and weekends that could be used for

computer-based adult education and training. Public computer terminals or kiosks could be located in churches, libraries, homeless shelters, and community centers, as well as schools. The barriers to locating technology are primarily cultural not technical; the ideal institutional locations are well respected in the community, provide some level of user support and encouragement, and are easily accessible by local residents. Community colleges, universities, and high-tech companies located in or near inner cities provide other sources of support—including equipment access, education, and training, not necessarily direct dollars—for inner city computing projects.

5. *Encourage development of computer software applications for minority users.* Inner cities need software and applications that are user-friendly for minority users and for those with English as a second language. Pacific Bell estimates, for example, that it has about 6.5 million customers statewide in California who speak English as a second language.

Workshop participants stressed the need for more active government support of inner city electronic delivery initiatives. Local governments can bring legitimacy to these initiatives, and can help involve local community groups that are essential to success. This would require that: 1) local governments take a much broader view of their role in electronic initiatives—a proactive rather than reactive role; 2) the Federal and State Governments support a more active local government role; and 3) funding mechanisms be established to pay for local government initiatives.

Participants concluded that the Federal Government needs more flexibility in supporting innovations in electronic service delivery. Not all innovations will succeed. Making progress means taking risks and accepting some failures. The government needs a much more robust mix of partnerships with local public and private organizations involved with information technology for the inner city. The government needs to be sensitive to: 1) the widespread skepticism of centralized or national solutions to local problems; 2) the desirability of a bottoms-up perspective to better ensure local involvement and success; and 3) the importance of technical flexibility, since no single technology is likely to address all needs (e.g., computer networking may be effective for inner city specialists and advocates, but kiosks may be better suited for inner city residents-at-large).

Citizens With Disabilities

Electronic service delivery should offer substantial advantages to persons with disabilities who now find it difficult or impossible to deal with delivery mechanisms that involve a lot of paper documents and/or physical travel. Computer and telephone attachments are now available that permit persons with sight, hearing, speech, or mobility impairments to use these technologies, and the costs are declining.[12]

OTA identified several opportunities and challenges that need attention to assure equitable access to electronic delivery for persons with disabilities:

- kiosks or multimedia work stations—need wheelchair accessibility for persons with lower limb mobility impairments, a standard interface that can communicate with customized computers and specialized input devices for persons with upper limb mobility impairments, redundant input and output modes (e.g., touchscreen, braille or symbol keyboard, voice synthesis) for persons with vision or hearing impairments, and directional and locational cues (to help users identify input and output devices and capabilities);

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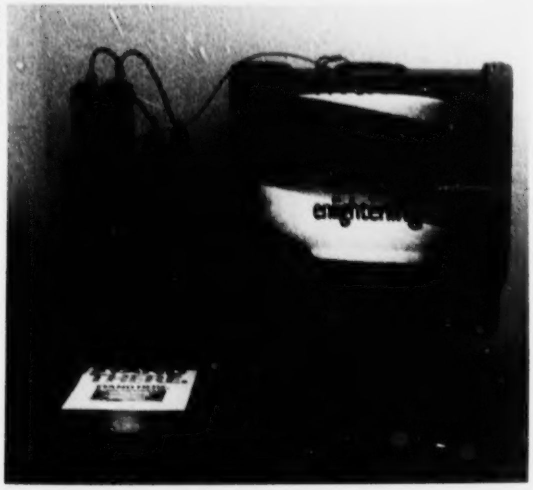
[12] For detailed discussion, see U.S. General Services Administration, Information Resources Management Service, *Managing Information Resources for Accessibility* (Washington, DC: GSA/IRMS, December 1991); Johns Hopkins University, Applied Physics Laboratory, *Johns Hopkins National Search for Computing Applications To Assist Persons With Disabilities, Proceedings* (Los Alamitos, CA: IEEE Computer Society Press, February 1992); Carl Brown, "Assistive Technology Computers and Persons with Disabilities," *Communications of the ACM*, vol. 35, No. 5, May 1992, pp. 36-45.

- computers with telecommunications interfaces—wheelchair accessibility is usually not a problem, and specialized input devices and redundant input and output modes are well developed; the major challenge is adapting specialized equipment to handle rapidly advancing software, graphics, and networking options, and including standard interfaces and functions in the design and manufacture of information technology to accommodate persons with disabilities;
- magnetic stripe or smart cards—terminals must be accessible to persons with wheelchairs or other mobility aids; the major challenge will be accommodating persons with upper limb mobility or vision impairments through the use of visual and aural cues, directional and locational cues, redundant instructions, and specialized cards or input devices (e.g., cards with physical markers and encoded instructions);
- videoconferencing—conference rooms must be accessible to persons with mobility aids; the major challenge is accommodating persons with severe vision or hearing impairments through screen augmentation and sound amplification systems, and using visual and aural cues or interpretations.[13]

In most cases, electronic delivery should be accessible to persons with disabilities if the technology is developed and applied appropriately. This presumes continued progress in developing open systems and technical standards that support a variety of hardware, software, and input/output devices, and further development of the market for assistive technology so that opportunities for economies of scale can be realized. It is much cheaper to build assistive capabilities into the electronic delivery systems and equipment (including software) up front than to retrofit at a later time. The participation of persons with disabilities and their advocates is essential to assure that such systems and equipment are user-friendly and affordable. Some persons have disabilities that prevent meaningful access, even with the best available technology (e.g., persons who cannot hold or manipulate a magnetic stripe or smart card). In these cases, alternative access options will be needed, including the use of technical substitutes and human attendants.[14]

Current Federal law can reasonably be interpreted to require that Federal services be accessible to persons with disabilities—regardless of the format in which the services are delivered. Section 504 of the Rehabilitation Act states that:

> No otherwise qualified handicapped individual in the United States . . . shall, solely by reason of his handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance or under any program



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Low-vision reading equipment for users with vision impairments, located at the high-tech laboratory for students with disabilities, California State University at Sacramento.

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[13] For the complete discussion, see J. Scott Hauger, Virginia Technology Associates, Ltd., "Ensuring the Accessibility of New Technologies for the Electronic Delivery of Federal Services for Persons with Disabilities," contractor report prepared for the Office of Technology Assessment, Jan. 20, 1993.

[14] Ibid.

> or activity conducted by any executive agency. . . .[15]

The Federal commitment to accessible Federal programs and services, and to accessible State/local and private sector activities as well, is reflected in several other statutes.[16] OTA field visits and interviews found a growing awareness of the possible implications of electronic delivery for persons with disabilities, but as yet no coherent strategy or program for addressing this topic. Congress and the administration could reaffirm existing law and regulations[17] and require that, in developing electronic delivery strategies, agencies address the needs of employees and citizens with disabilities. Existing Federal technical assistance centers could assist in this process.[18]

Senior Citizens

Senior citizens comprise one of the fastest growing groups in the United States, but one with relatively little exposure to computers. Most senior citizens do not own a personal computer (PC) and have limited, if any, experience with PCs. Computers as we know them today did not exist when the current generation of senior citizens went to school. Most retired before the advent of PCs in the office. Many must live on fixed incomes with limited funds for discretionary expenditures such as computers, software, and on-line time. Yet most need or could benefit from a variety of government services, and could, in principle, take advantage of electronic delivery.

SeniorNet is a good example of what it takes to effectively reach senior citizens.[19] SeniorNet is a not-for-profit organization dedicated to providing accessible, affordable computer services to senior citizens. It currently has about 8,000 members who pay $25 per year for educational materials, discounted computer equipment and services, and the opportunity to take computer classes (at no additional cost) at the 55 SeniorNet learning centers located at senior centers in 23 States. Its computer classes are geared to the needs of many senior citizens for a modestly paced curriculum with ample time for hands-on practice and personalized instruction.

About 2,000 members use the SeniorNet on-line computer conferencing and bulletin board service available over a commercial value-added telecommunications vendor, at the discounted rate of $9.95 per month for unlimited use during nonpeak hours. SeniorNet has negotiated deep discounts not only with the telecommunications vendor for computer conferencing, but with various equipment and software suppliers. SeniorNet computer classes are free, after the annual fee, due to private foundation and corporate funding. SeniorNet has found that both mobile and homebound senior citizens can benefit from computer-based services, and that many participating senior citizens use computer conferencing for social as well as educational or informational purposes. It also is encouraging the use of computer conferencing for intergenerational activities, for example between senior citizens and elementary and secondary students. SeniorNet has demonstrated, overall, that user-friendly, low-cost training and access make it possible for senior citizens to benefit from computer-based services.

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[15] Rehabilitation Act of 1973, Public Law 93-112, as amended by Public Law 99-506 and Public Law 102-569 (see footnote 16).

[16] See Sec. 508, Electronic Equipment Accessibility, of Public Law 99-506, An Act to extend and improve the Rehabilitation Act of 1973; the Technology Related Assistance to Individuals with Disabilities Act of 1988, Public Law 100-407; the Telecommunications Accessibility Enhancement Act of 1988, Public Law 100-542; the Americans With Disabilities Act of 1990, Public Law 101-336; and the Rehabilitation Act Amendments of 1992, Public Law 102-569. Also, H.R. 1757, the National Information Infrastructure Act of 1993, approved by the House on July 26, 1993, requires that computer networking applications "be accessible and usable by . . . historically underserved populations and individuals with disabilities."

[17] 41 CFR 201 of the Federal Information Resources Management Regulations (FIRMR) specifies that agency acquisition of information-processing resources must be conducted in a manner that ensures access by persons with disabilities.

[18] These centers include the GSA's Clearinghouse on Computer Accommodation, Department of Veterans Affairs' Computer Training Program for Persons with Disabilities, and Department of Defense's Computer/Electronics Accommodations Program. Also, the Architectural and Transportation Barriers Compliance Board, established by section 502 of the Rehabilitation Act of 1973, is responsible for promoting accessibility for individuals with disabilities. The Board is tasked by the Americans With Disabilities Act of 1990 to help assure accessibility to buildings and facilities covered by the Act. The Board's mandate includes automated teller and fare vending machines, for example, that are directly relevant to electronic service delivery. See, for example, Architectural and Transportation Compliance Board and Department of Transportation, "Americans With Disabilities Act Accessibility Guidelines: Accessible Automated Teller Machines and Fare Vending Machines," *Federal Register*, vol. 58, No. 134, July 15, 1993, pp. 38204-38211.

[19] See Mary Furlong and Greg Kearsley, *Computers for Kids Over 60* (San Francisco, CA: SeniorNet, 1993); Marcie Schwarz and Joanne Taeuffer (eds.), *The SeniorNet Sourcebook: A Collection of Creative Computing Projects* (San Francisco, CA: SeniorNet, 1993); and Marcie Schwarz and Jamie Sullivan (eds.), *Portraits of Computer-Using Seniors* (San Francisco, CA: SeniorNet, 1991). Also see Susan Koch, *Realizing the Benefits of New Computer and Telecommunication Technologies for Older Americans* (Washington, DC: National Association of Area Agencies on Aging, 1993).

The SeniorNet concept could be expanded to many more senior citizen centers in areas with high concentrations of older Americans, and to community centers, libraries, and information and referral (I&R) offices. Few community centers at present offer computer-based services, but the potential is great. Community centers are prime locations for electronic kiosks. The majority of public libraries now provide at least some microcomputer and compact optical disk services for patrons. Libraries generally do not charge for in-house computer activities, but do assess fees to recover costs of searching on-line databases. University and public libraries that are members of the Federal Depository Library Program have additional responsibilities to make Federal information (including information on Federal services) available to all citizens who walk in the door—including senior citizens.

Many communities also have I&R offices or 1-800 numbers that help citizens in need locate government or private sector services, and refer citizens to the appropriate service. Many I&R offices are jointly funded by local voluntary organizations and Federal or State/local governments. Most I&R offices already serve senior citizens, and some are beginning to explore greater use of information technology—including search and retrieval software and computer conferencing or networking among providers.

The key to meeting senior citizen computing needs is effective partnering among: 1) government agencies that provide or fund services for senior citizens; 2) voluntary and not-for-profit organizations that help senior citizens locate and use these services; and 3) commercial vendors of equipment and services that are willing to offer senior citizens, and organizations that serve them, deeply discounted rates.

STRATEGIC PARTNERING FOR ELECTRONIC SERVICE DELIVERY

Another potential component of electronic service delivery with high leverage is the forging of strategic partnerships among Federal, State, and local governments; user groups; and, where appropriate, the private sector (including not-for-profit, philanthropic, and voluntary as well as commercial organizations). Many State and local governments are beginning to view and use information technology as a catalyst for rethinking their own mechanisms for service delivery.[20] And a wide array of Federal services already involve significant State/local participation.[21] Partnerships in electronic delivery, however, are only in the formative stages.

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[20] See David Osborne and Ted Gaebler, *Reinventing Government: How the Entrepreneurial Spirit Is Transforming the Public Sector* (Reading, MA: Addison Wesley, 1992); David Osborne, *Laboratories of Democracy: A New Breed of Governors Creates Models for Economic Growth* (Boston, MA: Harvard Business School Press, 1990). Also see State Information Policy Consortium, "National Information and Service Delivery System: A Vision for Restructuring Government in the Information Age," 1992, available from the National Governors' Association, National Conference of State Legislatures, and Council of State Governments; and Patricia T. Fletcher, Stuart I. Bretschneider, and Donald A. Marchand, *Managing Information Technology: Transforming County Governments in the 1990s* (Syracuse, NY: Syracuse University School of Information Studies, August 1992).

[21] See Council of Governors Policy Advisors, *New Alliances in Innovation: A Guide to Encouraging Innovative Applications of New Communication Technologies To Address State Problems* (Washington, DC: National Governors Association, 1992). Also see Charles M. McClure, Rolf T. Wigand, John Carlo Bertot, Mary McKenna, William E. Moen, Joe Ryan, and Stacy B. Veeder, Syracuse University School of Information Studies, "Federal Information Policy and Management for Electronic Services Delivery," contractor report prepared for the Office of Technology Assessment, Dec. 21, 1992.

Effective partnering likely will require a true commitment from agencies to aggressively seek partnering opportunities and to make them work. A systematic exploration of partnering possibilities should include:

1. other Federal agencies delivering similar or related services;
2. State/local agencies that participate in delivering these or related Federal services;
3. private not-for-profit organizations such as colleges, hospitals, and community development groups that do or could participate;
4. voluntary consumer, community, youth, senior citizen, and related groups that could assist with service delivery;[22]
5. foundations and other philanthropic organizations that could provide seed money or matching grants; and
6. private commercial companies that make or sell the electronic equipment, systems, and services needed for electronic delivery, or that deliver substantive services similar to those provided by the government.

While Federal agencies could be required to at least explore these possibilities, the specific partnering arrangements will vary widely from case to case. Partnering may not be appropriate in some situations, and indeed can be harmful if the match between partners and services is not comfortable (i.e., a "forced fit"). Successful partnering requires a good match between program objectives, service providers, users, and appropriate technologies and expertise.

Partnering could offer several benefits. It should provide a way for Federal and State/local agencies to share the costs and risks of innovation in electronic delivery. The fiscal crises facing the Federal and most State Governments provide further impetus for partnering. At the same time, partnering should increase the chances of success by encouraging better understanding of the needs of users and providers, and stimulating creative thinking about new or improved service delivery strategies. It also could be a constructive catalyst for change that leads to more productive, efficient, and responsive service delivery. Strategic partnerships flourish and succeed when the partners realize that by working together, they can accomplish what they could not do alone. Partnerships could help agencies break through or work around the bureaucratic and political inertia that often confronts new ideas for service delivery.

Electronic delivery partnerships examined by OTA (e.g., WyoCard and InfoCal[23]) typically began with an exploration of project feasibility, followed by a pre-operational or demonstration activity, and then moved to full implementation (see box 5-C for keys to the WyoCard success). The results of OTA's field visits and contractor research suggest that successful partnerships are likely to include many of the steps or activities shown in table 5-1.

Congress or the administration could assign a lead Federal agency (or agencies) the task of fleshing out the table 5-1 framework and preparing a "Guidelines or Checklist for Successful Electronic Partnering," perhaps as one of a series of papers on general strategies for electronic delivery. The partnering checklist could readily build on similar State/local government initiatives.[24] The Federal Government also could establish an incentive program for partnering, including:

1. recognition and performance awards,
2. an annual conference,
3. partnership set-asides (as a percentage of program budgets or agency information technology budgets, e.g., one-half of one percent),

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[22] See John Harris and Alan F. Westin, "Non-Profit and Academic Applications of Computer and Telecommunication Technologies," contractor report prepared for the Office of Technology Assessment, December 1991.

[23] WyoCard is evolving into a multiprogram, multiagency electronic benefit transfer card. See ch. 4 for discussion. InfoCal is evolving into a multiprogram, multiagency information and service kiosk. See ch. 2.

[24] See Council of Governors Policy Advisors, op. cit., footnote 21.

Box 5-C—WyoCard: Keys to Success

The State of Wyoming's WyoCard project tested the use of off-line smart cards for delivering Women, Infants, and Children (WIC) benefits to recipients in Natrona County (Casper area). A smart card called the WyoCard was used as a substitute for the traditional paper voucher system for delivering benefits. Here are some of the reasons the test worked well:

- The Wyoming State WIC director articulated a clear vision of WyoCard, and provided strong leadership and guidance.
- The WIC director helped change the State government's mindset regarding service delivery and the role of information technology.
- The WyoCard project staff reached out to recipients, retailers, banks, local voluntary organizations, and technology vendors—as well as Federal/State agency officials—from start to finish.
- The WyoCard staff held a planning retreat with participants early in the project.
- The WyoCard staff developed project plans that described how technology could deliver WIC services more cost effectively, and that outlined the key issues and options.
- WyoCard staff built technology flexibility into the plan and sought nonproprietary technical solutions to the extent possible, in order to reduce costs and simplify procurement and operations.
- WyoCard staff set up an advisory panel of participants and experts to help ensure effective communication during the life of the project.
- Staff developed training materials—including a short, inexpensive videotape for use at the nutrition clinics where the WIC program is locally administered—and made sure that local retailers, clinic staff and volunteers, and recipients received adequate training.
- Staff set up a technology demonstration in a local clinic to test participant understanding and help assure a user-friendly system.
- Staff tested the technology both on- and off-site to validate the system design prior to procurement.
- Recipients, retailers, banks, and government staff were uniformly pleased with the WyoCard project results (see box 4-B, ch. 4 for details).

SOURCE: Office of Technology Assessment, 1993.

Table 5-1—Illustrative Checklist for Successful Partnering In Electronic Service Delivery

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Exploratory/planning stage

- project planning task force
- community workshop or retreat
- technology demonstration or sharing center
- local advisory committee

Pre-operational stage

- cooperative development of operating rules (e.g., assignment of technical and programmatic responsibilities)
- early resolution of key issues (e.g., cost- and risk-sharing)
- creative use of requests for information (RFIs) and proposals (RFPs)
- pilot projects and demonstrations

Operational stage

- scaling up roles and resources
- incorporating pilot-test results
- selecting lead agencies and participants
- firming up the commitments (and responsibilities) of all partners
- providing training and user support
- building in a periodic evaluation component

SOURCE: Office of Technology Assessment, 1993.

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4. innovative ways to share lessons learned, and
5. streamlining of Federal guidelines and procedures for cost reimbursement for the Federal share of strategic partnering.

Local Community Infrastructure

The involvement of the local community infrastructure in strategic partnerships can greatly facilitate electronic service delivery. Schools, libraries, community centers, town halls, and hospitals offer some of the most highly leveraged opportunities because these locations are typically heavily used and well respected, and provide a multiplier effect for technology investments. At the local level, technologies and locations suitable for multiple users offer the greatest return on investment.[25] The concept of the community communications center has considerable merit. Local high schools frequently serve this purpose in small towns and rural areas. Educational institutions in general—whether high schools, community colleges, or universities—are very interested in using information technology, tend to be more familiar with the technology than the community-at-large, and are well suited to the training needs likely to be associated with major electronic delivery initiatives.[26] Schools and hospitals already benefit from ongoing Federal and State computer, distance learning, and telemedicine programs. The key is to find synergies between these and the many other government programs that collectively can provide the building blocks for electronic service delivery.

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Chukchi College of the University of Alaska is home for the Kotzebue Public Library and provides microcomputer access for Kotzebue residents of all ages.

Kotzebue, Alaska, is a case in point. Located just above the Arctic Circle with a population of about 3,000, this Native Alaskan village is accessible year round only by air, with no land access and sea access only during the ice-free months. In a small village like Kotzebue, the high school, hospital, and community center might collectively justify the installation of multimedia work stations and videoconferencing facilities at a village communication center, but not individually. The hospital needs the ability to have video interaction with medical specialists in Fairbanks, Anchorage, and sometimes even Seattle, Washington. The hospital cannot afford to have specialists on staff, and few specialists will fly to Kotzebue. The only option in serious cases is flying the patients out at great expense and family dislocation. The local schools could likewise benefit from distance education. And the community, including the village

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[25] See Office of Technology Assessment, U.S. Congress, *Rural America at the Crossroads: Networking for the Future*, OTA-TCT-471 (Washington, DC: U.S. Government Printing Office, April 1991).

[26] See generally Office of Technology Assessment, U.S. Congress, *Linking for Learning: A New Course for Education*, OTA-SET-430 (Washington, DC: U.S. Goverment Printing Office, November 1989).

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government, could benefit from enhanced teleconferencing with State and Federal officials in Anchorage and Juneau, and potentially even in Washington, DC. Villages and towns like Kotzebue are ideally suited for implementation of "rural area networks" to share computer and telecommunications resources.[27]

OTA field trips identified numerous other examples of opportunities to develop the community information infrastructure that could support electronic service delivery. Community colleges and universities are particularly well suited (see box 5-D).

Partnering can help assure equitable access to electronic service delivery. Combining the grassroots involvement program discussed earlier with a local community infrastructure initiative, if backed up with funds (whether by set-asides or otherwise), would go a long way towards building up (and on) local expertise and access. A community infrastructure initiative for electronic delivery could be supported with funding from both mission agency demonstration and operational programs (e.g., Department of Agriculture for electronic benefit transfer) and Federal grant programs (e.g., National Science Foundation for campus computer networking, Department of Education for public school networking). The National Public Telecomputing Network, Big Sky Telegraph, and Institute for Global Communica-

Box 5-D—The Community Information Infrastructure: A Key Role for Colleges and Universities

- *Laramie Community College,* Laramie, WY—With about 2,500 students, the college has over 550 personal computers in 12 computer labs. The college keeps one lab open to any resident of the Cheyenne community at very nominal charges (e.g., $45/year, $15/semester, $2/hour). This appears to be a great asset for those who cannot afford or do not need their own computer. The college offers an extensive distance-learning program—using a public access cable TV channel and/or two-way audioconferencing—for homebound persons, farmers, ranchers, and others who find it difficult to come to the campus. The college has a videoconferencing facility—with one-way satellite video and two-way compressed video—that is also available for local community and State government use.
- *Rasmuson Library,* University of Alaska, Fairbanks—The library is strongly committed to open access. Anybody can use the on-site library resources; a student ID card is not required. Local high school students are among the heaviest users. The library's government documents collection, the largest in the State, gets extensive use. The library is philosophically oriented to the broader mission of information provider to the public-at-large, especially including public libraries and schools in rural Alaska, not just the university community. The library is addressing a range of cost, pricing, copyright, training, and networking issues to help provide affordable remote electronic access.
- *Little Big Horn Tribal College,* Crow Agency, MT—The college has made a major commitment to the use of computers in its educational program. The two fully equipped computer labs and one smaller lab—with a combined total of about 40 personal computers—are open 12 hours a day, 8 a.m. to 8 p.m., and available for use by any registered student on a virtually unlimited basis (except when computer lab classes are in progress). Student interest is high. The college has to scramble to find money for computers, relying largely on foundation and government grants, and makes only limited use of computer conferencing and distance learning—although the potential is great. The college's primary mission is to build up the local community; about 90 percent of the graduates stay in the Crow Reservation area.

SOURCE: Office of Technology Assessment, 1993.

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[27] For discussion of rural area networks, see U.S. Congress, Office of Technology Assessment, *Rural America at the Crossroads,* op. cit., footnote 25.

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tion[28] are among those not-for-profit private organizations that provide grassroots computer networking services. These and similar organizations could be used for electronic delivery of Federal services, and this model could be tested with other technologies (e.g., kiosks).

On a national scale, Congress and the President could establish a Corporation for Public Telecomputing or, perhaps more broadly, a Corporation for Electronic Service Delivery, as a parallel to the Corporation for Public Broadcasting (CPB).[29] This Corporation could provide grants, exchange innovative ideas, and sponsor demonstrations of grassroots public involvement in electronic delivery. CPB itself has embarked on a partnership with local public television stations and schools to provide a nationwide satellite-based videoconferencing and interactive data network. This network will be used for electronic delivery of educational services and could, in principle, serve as another vehicle for Federal service delivery.

Federal funding for local initiatives could be provided in part through the diverse array of existing or proposed Federal agency programs relevant to electronic delivery. These include: 1) the Public Telecommunications Facilities Program (administered by the National Telecommunications and Information Administration [NTIA]); 2) the proposed computer networking pilot project program (also to be administered by NTIA); 3) the U.S. Public Health Service's Community Services Network Project to develop user-friendly multimedia terminals for citizens and health care workers to access a wide range of health-related services and information; and 4) the Department of Agriculture's plan to use information technology to help county extension offices become part of the local electronic services and information infrastructure.[30] Whether through existing or new mechanisms, congressional and executive actions to support the grassroots community infrastructure would be highly leveraged in assuring the success of Federal electronic service delivery.[31]

Private Commercial Sector

The private commercial sector is another essential partner in electronic service delivery. Private vendors are the suppliers of the telecommunications equipment, computers, and vast array of peripheral equipment and software needed for electronic delivery. The Federal Government should use, to the maximum extent possible, the latest off-the-shelf technology obtained through standard competitive procurement procedures. Some private firms may, on occasion, wish to underwrite joint development projects and pilot tests, or provide discounted or donated equipment, as is done routinely with schools and colleges. This practice, if extended more vigorously to grassroots not-for-profit groups, could help assure equity of access to electronic service delivery.

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[28] The Institute for Global Communications, headquartered in San Francisco, CA, operates the EcoNet and PeaceNet family of computer bulletin boards and conferences, and provides gateway access to numerous other public interest computer networks.

[29] The Corporation for Public Telecomputing concept originated with Thomas Grundner, President, National Public Telecomputing Network. See T.M. Grundner, "The Fourth Scenario: On the Federal Development of Public Access Computerized Information and Communication Services," January 1993, and "Toward the Formation of a Corporation for Public Cybercasting," April 1993. Copies available from T.M. Grundner, Internet tmg@nptn.org, phone 216-247-5800, fax 216-247-3328. The State of Oregon has proposed creating a private, not-for-profit "Oregon Telecommunications Foundation" to serve as a catalyst and support pilot projects with matching funds to be raised from private and philanthropic sources. See State of Oregon, Department of Economic Development, "Oregon Connects: A Telecommunications Vision and Plan for the 21st Century," Salem, OR, September 1992.

[30] See U.S Department of Agriculture, Extension Service, Communication and Information Technology Division, "Future Applications of Communication Technology: With Implementation Recommendations," July 1991, and "Future Applications of Communication Technology: Strategic Implementation Plan for the Cooperative Extension Service," November 1992.

[31] For other ideas on community information infrastructure development, see Richard Civille, Computer Professionals for Social Responsibility, "Broadening the Research Community: Delivering Federal Services Using Information Technology," contractor report prepared for the Office of Technology Assessment, December 1992; John Harris, Alan F. Westin, and Anne L. Finger, "Innovations for Federal Service: A Study of Innovative Technologies for Federal Government Services to Older Americans and Consumers," contractor report prepared for the Office of Technology Assessment, February 1993; and Dutton, "Electronic Service Delivery and the Inner City," op. cit., footnote 5.

Private vendors also are the primary providers of the telecommunications and computer networks needed for electronic delivery. The Federal Government has opted to use private commercial networks, rather than build its own (except in rare cases of national security). FTS2000, for example, is not a physically separate telecommunications network built for the Federal Government, but is essentially a bulk purchase agreement for Federal use of commercially available telecommunications networks and services. A few States and educational systems, and many more private businesses, have opted to build their own private telecommunication networks.[32] But Federal electronic service delivery will be most cost effective for the largest number of recipients by using commercial offerings, including the public switched telephone network and other publicly available telecommunication and value-added networks. As with equipment, some private firms provide telecommunication and network services to schools and libraries at discounted rates, especially during off-peak hours of use. Other local community and grassroots organizations likewise would benefit from this discount program.

Private companies also can serve as systems integrators for electronic delivery systems, as has been the case for many large Federal (and State/local) agency automation programs over the last decade. They also add further value to government services and independently market these enhanced services. Direct involvement of the private commercial sector in the delivery of Federal services, beyond providing the equipment and networks, requires attention to issues that have proven to be sensitive and controversial in the past. These include providing for fair competition, avoiding conflicts of interest, assuring an appropriate level of Federal control over taxpayer-supported services, and guaranteeing equity of citizen and taxpayer access to services. Congress would need to review and update the relevant policy framework as needed, in order to have a smooth transition to electronic delivery (see ch. 7 discussion of contracting out/procurement).

Private sector motivations for partnering can extend beyond research, market development, and direct sales. Private companies are themselves recipients of many Federal services; electronic delivery should present companies with opportunities for cost savings and innovation. Technologies such as electronic data interchange and automated voice/fax/computer response could drastically reduce the Federal paperwork burden and accelerate electronic collection of information from businesses. Entrepreneurs large and small could access valuable trade, market, and technical leads faster and at lower costs. Government electronic delivery initiatives could help stimulate development of commercial market opportunities and strengthen the overall competitive posture of the U.S. financial industry.[33] Private companies increasingly recognize that, when it comes to electronic service delivery, what is good for government is also good for business.[34]

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[32] The State of Iowa has purchased its own fiber optic network for educational, governmental, library, emergency, and other public uses. See Iowa Department of General Services, Communications Division, "ICN—Iowa Communications Network: Information Highway of the Future," n.d. Also see Interagency Information Resources Management Infrastructure Task Group, Iowa Communications Network Working Group, "Iowa Communications Network Study," General Services Administration, Washington, DC, Apr. 1, 1993, for discussion of Federal/State opportunities and issues.

[33] See chs. 2 and 3.

[34] For further discussion, see Office of Technology Assessment, U.S. Congress, *The Electronic Enterprise: Opportunities for American Business and Industry*, in progress.

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Revitalizing Information Resources Management for Electronic Delivery

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SUMMARY

How can the Federal Government get the highest return on the $25 billion of taxpayer money spent each year on information technology? Enactment of the Paperwork Reduction Act (PRA) in 1980 was based in part on the belief that an integrated, systematic approach to managing information technology—under the rubric of "information resources management" or IRM—would pay off in the long run. Congress amended and reauthorized the PRA for 3 years in 1986; since then efforts to further extend and update the PRA have not yet succeeded.[1]

Although the IRM concept still is sound, IRM at the Federal level has not kept up with changes in technology and the growing trend for State and local governments to use computers and telecommunications to serve their residents. The Office of Management and Budget (OMB), General Services Administration (GSA), and various individual Federal agencies have joined the "service to the citizen" movement. But the pace and creativity of Federal IRM changes are falling short of the levels needed to manage the transition to electronic service delivery.

A new IRM planning and budgeting process is needed. OTA identified seven key electronic delivery "success factors" that should be reflected in all Federal agency IRM plans and budgets:

1. grassroots involvement,
2. community infrastructure development,

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[1] The Paperwork Reduction Act of 1980, Public Law 96-511, was amended once by the Paperwork Reduction Reauthorization Act of 1986, Public Law 99-500. Subsequent reauthorization proposals included S. 1742, the Federal Information Resources Management Act of 1989, Oct. 6, 1989; H.R. 3695, the Paperwork Reduction and Federal Information Resources Management Act of 1989, Nov. 17, 1989; S. 1044, the Federal Information Resources Management Act of 1991, May 14, 1991; and S. 1139, the Paperwork Reduction Act of 1991, May 22, 1991. Proposals to reauthorize the PRA are before the 103rd Congress. See S. 681, the Paperwork Reduction Reauthorization Act of 1993, Mar. 31, 1993; S. 560, the Paperwork Reduction Act of 1993, Mar. 10, 1993; and H.R. 2995, the Paperwork Reduction Act of 1993, Aug. 6, 1993.

3. innovation (including separate funding and a clearinghouse for sharing results),
4. directories (to services and information),
5. consideration of future service delivery alternatives,
6. strategic partnering, and
7. pre-operational testing (including evaluation and policy development components).

Congress and the administration could require that these factors be adequately addressed in project-level, annual, and 5-year plans developed by the line agencies, and that some factors be funded through percentage set-asides from agency information technology budgets.

The IRM leadership and training should be strengthened and refocused. Each Federal agency needs an experienced, senior official who can bridge the gap between information technology and service delivery—whether called the senior IRM official, an assistant secretary-level Chief Information Officer, or the equivalent. The Federal IRM training program should be revamped, placing emphasis on strategic thinking, technology and policy integration, flexible planning and procurement, and customer service—along with the "success factors" noted above. Knowledgeable and committed Federal employees are essential to successful electronic delivery of services, and should be involved at every stage of electronic delivery initiatives.

Congress and the President could take the opportunities presented by electronic service delivery and PRA reauthorization to update Federal IRM, and also to rethink the Federal IRM organizational structure. OMB's Office of Information and Regulatory Affairs, GSA's Information Resources Management Service, and the National Institute of Standards and Technology's Computer Systems Laboratory, among others, could benefit from a large dose of creativity in how to best leverage scarce human, technical, and financial resources for electronic delivery. Electronic service delivery could play a key role in re-engineering the Federal Government, but significant IRM changes are a prerequisite to making this vision a reality.

INTRODUCTION

The IRM concept is relatively new (little more than a decade old) and was intended to provide an integrated approach to managing the hardware, software, personnel, services, and other components of the government's information technology activities. The IRM concept was not well defined when the Paperwork Reduction Act of 1980 was enacted, and is still very unevenly understood and accepted in government agencies. At the Federal level, the rapid advancement of information technology and its applications has made it difficult for IRM to fulfill its original promise.[2] The transition to electronic service delivery will further strain the IRM structure and staff, absent needed changes.

Information and information technology are central to the functions of a modern organization. Information technology unequivocally is evolving in the direction of multilevel, networked systems that integrate computers, telecommunications, and peripheral equipment with multiformat capabilities (e.g., voice, data, graphics, print, video, and optical). This trend alone argues for an integrative management approach. The new imperative for re-engineering or rethinking government inevitably will lead to viewing government services in relation to each other and to larger public goals, rather than in isolation. It also will encourage the development of common technical and organizational platforms for service delivery. These trends will, in turn, demand greater consistency and cooperation in the management of information resources. The greatest need and challenge, in this new environment, is not providing telecommunications and computer services to Federal agencies, but getting the agencies to think creatively about how information technology can best meet their needs.

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[2] See Charles R. McClure, Rolf T. Wigand, John Carlo Bertot, Mary McKenna, William E. Moen, Joe Ryan, and Stacy B. Veeder, Syracuse University School of Information Studies, "Federal Information Policy and Management for Electronic Service Delivery," contractor paper prepared for the Office of Technology Assessment, Dec. 21, 1992; U.S. General Accounting Office, *Information Management and Technology Issues*, GAO/OCG-93-5TR (Washington, DC: U.S. General Accounting Office, December 1992); U.S. General Accounting Office, *Perceived Barriers to Effective Information Resources Management: Results of GAO Panel Discussions*, GAO/IMTEC-92-67 (Washington, DC: U.S. General Accounting Office, September 1992); U.S. General Accounting Office, *Information Resources: Summary of Federal Agencies' Information Resources Management Problems*, GAO/IMTEC-92-13FS (Washington, DC: U.S. General Accounting Office, February 1992); U.S. Congress, Office of Technology Assessment, *Federal Government Information Technology: Management, Security, and Congressional Oversight*, OTA-CIT-297 (Washington, DC: U.S. Government Printing Office, February 1986); and Fred B. Wood, "Office of Technology Assessment Perspectives on Current U.S. Federal Information Issues," *Government Publications Review*, vol. 17, 1990, pp. 281-300. For the original legislative history of the PRA, see U.S. Congress, Senate, Committee on Governmental Affairs, *Paperwork Reduction Act of 1980*, Senate Report No. 96-930, Sept. 8, 1980.

Congress and the President could rethink IRM goals, planning, budgeting, training, and organization in the Federal Government, and then revise and update the PRA accordingly. The trend at the State level is to redefine IRM as a tool for achieving broader government and public objectives, rather than an end in itself. Significant changes will be needed to jump-start the Federal IRM bureaucracy to move in new directions. The Federal Government could learn from State and even local government experience in developing an innovative Federal IRM strategy. Part of the Federal strategy might include a strong emphasis on meeting citizen needs for services, grassroots community involvement, and strategic partnering—perhaps as explicit goals of Federal IRM. The Federal strategy also could adopt themes and goals that are emerging from State government efforts to improve IRM (see boxes 6-A and 6-B).[3]

NEW IRM PLANNING AND BUDGETING PROCESS

Both the Office of Management and Budget and General Services Administration have embraced the concept of electronic service delivery. OMB is on record that:

> . . . the IRM community should work to build a Federal service delivery infrastructure—using information technology better to perform its missions. At root this requires new partnerships within and across agencies. Specifically, these partnerships could support: improving interagency coordination in service delivery; testing new citizen-service technologies such as kiosks; increasing the active dissemination of government information; reducing administrative burden and paperwork through the use of information technologies; and creating policies and incentive structures that encourage innovation.[4]

GSA's fledgling "service to the citizen" program also has begun to bear fruit. Recent reports have highlighted the need for Federal agencies to become more customer-oriented, with an emphasis on the use of information technology to im-

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[3] Many States have strategic information technology plans that encompass at least some key aspects of electronic delivery. See, for example, Information Resources Commission, State of Florida, "Annual Report on Information Resources Management Fiscal Year 1991-92," February 1993; Information Technology Policy and Management Division, State of South Carolina Budget and Control Board, "Focus 1990s—Direct Citizen Access Using Modern Technologies—Strategic Information Technology Directions for the State of South Carolina," Columbia, SC, May 1991; and the references cited in boxes 6-A and 6-B. Also see Sharon L. Caudle and Donald A. Marchand, *Managing Information Resources: New Directions in State Government* (Syracuse, NY: Syracuse University School of Information Studies, August 1989); Nancy Ginn Helme, *New Alliances in Innovation: A Guide to Encouraging Innovative Applications of New Communication Technology To Address State Problems* (Washington, DC: Council of Governors Policy Advisors, 1993); State Information Policy Consortium, "National Information and Service Delivery System: A Vision for Restructuring Government in the Information Age," 1992, prepared for the National Governors' Association, National Conference of State Legislatures, and Council of State Governments; Alabama Information Age Task Force, "Founding a First World Alabama: Summary," n.d.; and Eliot Levinson, "Using Information Technology Effectively in Government Organizations," *Informatization and the Public Sector*, vol. 1, 1991, pp. 143-154.

[4] Office of Management and Budget, *Information Resources Management Plan of the Federal Government* (Washington, DC: U.S. Government Printing Office, November 1992), p. III-10.

Box 6-A—Learning From the States: California Strategic Directions

The California State Office of Information Technology (OIT), headquartered in Sacramento, is part of the Department of Finance, and is roughly equivalent in function to the Office of Information and Regulatory Affairs (minus the regulatory side) in the U.S. Office of Management and Budget. The California OIT carries out technology advocacy, policy development and oversight, and review and approval of agency information technology budgets. The OIT has a staff of 28 persons who oversee the activities of the more than 7,000 information technology-related employees in State agencies with a combined information technology budget of about $1.2 billion.

The OIT is refining and implementing a California 2000 plan reflecting fundamental changes in the State's information technology philosophy and direction:

1. *Shift from agency automation to electronic service delivery*—During the 1980s, the challenge was to educate agencies about the basic benefits of information technology for automating the internal agency functions. Now the focus is shifting to automation of external relationships between mission agencies and their clients, customers, and citizens.
2. *Shift from implementing agency-specific automation projects to developing a common information technology infrastructure.* The old model was to identify an agency-specific problem, define the needs, and develop and apply information technology to meet those needs. The new model is to invest in generic technologies that will meet a wide range of needs, not necessarily related to a specific agency or problem, in order to develop the common infrastructure and heavy volume of use needed to realize low-cost electronic service delivery.
3. *Shift from information technology as separate from government structure to technology as an integral part of government structure.* Fiscal constraints make it imperative to restructure and re-engineer California State government. Information technology can help cut across agency and program lines and provide opportunities for integrated service delivery, at first within the existing organizational structure but eventually leading to a re-engineered, streamlined structure. The hope is that information technology changes will lead naturally to organizational changes, with a lesser degree of political and personnel trauma than usually accompanies structural change. Information technology should result, over a few years time, in fewer mid-level managers, fewer computer programmers, more applications specialists and strategic thinkers, and a decentralized, democratized information technology infrastructure.
4. *Shift from information technology or automated data-processing staff as relatively narrow technical specialists to more innovative, broadly gauged application generalists.* Career paths need to be based not just on the size and complexity of technology managed, but on the impact and leverage of the technology to improve service delivery and government functioning.

Specific OIT initiatives include:

1. requiring agencies to have an explicit information technology strategic infrastructure plan, against which OIT will evaluate specific agency proposals;
2. providing training to help agency information technology staff gain new, broader perspectives, including a Data Processing Academy (about 4 to 5 weeks total class time spread over 1 year) and Executive Institute (a few days in duration);
3. supporting an advanced technology program that permits agencies to develop and test technologies outside of the normal procurement process;
4. supporting InfoCal as a kiosk-based component of the State information technology infrastructure; and
5. supporting the State Department of Motor Vehicles magnetic stripe card as a service delivery and identification card.

SOURCE: Based on OTA interviews with senior California State officials. For further discussion, see State of California, Department of Finance, Office of Information Technology, *Managing Information in California State Government: An Executive Perspective*, Sacramento, CA, December 1991, and *Office of Information Technology . . . Putting Information To Work: Programs and Organization*, Sacramento, CA, March 1992.

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Box 6-B—Learning From the States: Washington State Strategic Directions

The State of Washington has an aggressive strategy to harness information technology to change and improve State government. The State government leadership believes that information technology is a key resource that can be used to increase government productivity and improve service delivery. However, information technology is not an end in itself; it is a resource to be used to accomplish broader government objectives.

The State Office of Financial Management (equivalent in part to the Federal OMB) chairs an interagency subcabinet (Deputy Director level) group that meets about twice a month; the State Department of Information Services is responsible for policy development and implementation. Key statewide information technology issues and initiatives include:

1. use of the State government's personal computer infrastructure—the 50,000 installed personal computers (for 85,000 employees) offer substantial opportunities for local and wide-area network interconnectivity, electronic mail, document transfer, and the like;
2. the paperless government—how can the State government take advantage of the telecommunications and computer infrastructure to drastically reduce government paperwork;
3. citizen access to government—the State is looking at the full range of options, from kiosks to bulletin boards to videoconferencing, to improve access, reduce citizen trips to agencies, etc.;
4. horizontal services integration—how can information technology be used to combine service delivery across agency boundaries, such as consolidated business reporting forms and a master business license (that combines previously disparate licensing documents), or consolidated State information dissemination; and
5. capacity building—the intent is to use continuing education and training to help senior managers better understand the vital role of information technology and resources in transforming State government.

Leadership is key to the State of Washington's success. State information resources management must strike the right balance between providing centralized guidance and principles while encouraging innovation and allowing enough room for individual agency/program variability. The State is emphasizing the need for:

1. multiple focal points of expertise (e.g., agency IRM offices, statewide IRM support offices);
2. more public-private (e.g,. with private firms) and public-public partnerships (e.g., using distance education facilities for State agency hearings, working with Federal agency counterparts); and
3. leveraging opportunities for economies of scale (e.g., creating single points of presence where State and Federal services would be available over the same terminal facilities).

SOURCE: Based on OTA interviews with senior Washington State officials. For further discussion, see Washington State Department of Information Services, *Information Technology in Washington State Government: A Biennial Report*, Olympia, WA, June 1992; *New Directions in Information Resources Management: Information Technology Act of 1992*, Olympia, WA, June 1992; and *Improving the Management of Information Systems in Washington State: A Report to the Legislature*, Olympia, WA, Jan. 15, 1992.

prove the quality, accessibility, and cost effectiveness of service to citizens.[5]

Current OMB planning guidance, issued pursuant to the PRA, is moving agencies in the direction of thinking more strategically about their use of information technology. OMB asks agencies to supply information on "service to the citizen" projects, including:[6]

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[5] See U.S. General Services Administration, Information Resources Management Service, *Service to the Citizens: Project Report*, KAP-93-1 (Washington, DC: U.S. General Services Administration, February 1993); Jerry Mechling, Jane E. Fountain, Linda Kaboolian, and Steven Kelman, *Customer Service Excellence: Using Information Technology to Improve Service Delivery in Government* (Cambridge, MA: Harvard University John F. Kennedy School of Government, Program on Strategic Computing and Telecommunications in the Public Sector, June 1993), prepared with financial support from GSA and several other Federal agencies; and Vice President Al Gore, *Creating a Government That Works Better and Costs Less: Report of the National Performance Review* (Washington, DC: U.S. Government Printing Office, Sept. 7, 1993).

[6] Office of Management and Budget, "Information Resources Management Plans Bulletin," OMB Bulletin 93-12, Apr. 28, 1993.

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- impetus for the project;
- how the project works;
- level of citizen effort required to participate;
- phase of the project life cycle;
- agency coordination;
- legal, regulatory, or technical impediments;
- project evaluation (planned or completed); and
- project benefits.

OMB intends to use this information to create an inventory of projects and identify needed policy changes, and as input to next year's governmentwide information resources management plan.[7] And OMB further acknowledged the role of electronic delivery in its recently revised information resources management circular.[8]

The results of these OMB and GSA initiatives, while likely to be useful, fall short of adequately focusing agency attention and resources on keys to successful electronic delivery.

In addition to grassroots citizen involvement and strategic partnering, ingredients of successful electronic service delivery projects are likely to include: *vision*—a clear idea of where the project is going and what needs or goals are to be met; *innovation*—creative application of technology and/or rethinking of how services can be delivered; and *pre-operational testing*—an opportunity to check out the design concept before committing to large-scale development and deployment, including explicit evaluation and policy development components. Many Federal and State/local government agencies, as well as private sector organizations, have learned through experience that the absence of one or more of these elements can spell trouble.[9]

The challenge is building vision, innovation, and pre-operational testing, as well as grassroots involvement and partnering, into the overall planning and budgeting process—without simply adding more layers of bureaucratic procedures and red tape. Congress and the administration could require that the annual and 5-year information technology plans currently prepared by Federal agencies explicitly address these and other key elements,[10] but give the agencies considerable discretion about how to carry out this requirement. Agency planning has matured considerably since enactment of the PRA in 1980, but still leaves room for improvement as a forward-looking, creative process. Congress could further amend the PRA to provide more direct guidance on agency planning and budgeting for electronic delivery. OMB could revise its various bulletins and circulars to do likewise, as could GSA with regard to its Federal IRM regulations and manuals.

Fostering a clear vision is partly a function of a government leadership that encourages creative thinking about using information technology to help improve service delivery. Vision is also strengthened by hiring and training in-house futurists and entrepreneurs who will push agencies to fresh insights; by organizing workshops, retreats, and seminars for agency staff and outside innovators to think openly about re-engineering agency functions; and by providing incentives and rewards for those who produce insightful, useful applications of electronic service delivery. OMB is taking initial steps in this direction by requiring linkages between agency strategic goals and the use of information technology to improve service delivery,[11] but, at this point, the OMB guidance is not sufficiently refined or focused. OMB could redirect existing advisory mechanisms, or create new ones, to generate more creative ideas on electronic delivery both from within and outside the

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[7] Issued annually by OMB.

[8] Office of Management and Budget, OMB Circular A-130 Revised, "Management of Federal Information Resources," *Federal Register*, vol. 58, No. 126, July 2, 1993, pp. 36068-36086; see sec. 7(l): "Modern information technology presents opportunities to improve the management of government programs to provide better service to the public . . ."

[9] See U.S. Congress, Office of Technology Assessment, "Montana/Wyoming Trip Report," "Alaska Trip Report," "California Trip Report," Nov. 10, 1992; Caudle and Marchand, *Managing Information Resources*, op. cit., footnote 3.

[10] See key information and communication policy concerns discussed in ch. 7.

[11] See OMB Bulletin 93-12, op. cit., footnote 6.

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The State of California's Franchise Tax Board has invested heavily in automated voice response technologies to provide faster, more accurate answers to inquiries from California taxpayers.

Federal Government.[12] Advisory groups should be encouraged to use electronic technology, such as computer and videoconferencing, to facilitate their work.

Some States and private companies have experimented with innovation funds—i.e., a small amount of risk money (not so small for some companies) set aside for innovative projects and applications where success is not guaranteed. Private companies have learned to invest in multiple projects and approaches, knowing that not all will succeed but that the greater failure is not to try. Taking risks is harder to politically justify when taxpayer dollars are involved. But in the long run, the public is likely to be well served by encouraging agency innovation in electronic service delivery. Congress and the administration could encourage or mandate that a percentage of every agency's information technology budget be reserved for small-scale innovation. Just one-half of 1 percent would create a governmentwide electronic delivery innovation fund of about $125 million.

An innovation fund (or separate agency funds) could and probably should be disconnected from operational or pre-operational electronic delivery programs in order to avoid competition for funds and excessive red tape. Once a specific electronic delivery application reaches the pre-operational stage, then more explicit and rigorous guidelines usually are needed.

Deciding on specific technical systems for service delivery will still be complicated because, as yet, most options have been tested on a relatively small-scale basis and without the benefit of fully competitive technology development. Numerous Federal, State, and local-level pilot tests or limited operational deployments of kiosks, dial-up computer access, and smart cards demonstrate that these technologies can work for electronic service delivery. But there are many unanswered questions about scaling up to regional or nationwide applications that are fully operational and cover multiple programs.[13]

Indeed, it is premature to make detailed technical and operational decisions on large-scale nationwide electronic delivery systems. Congress and the administration could, however, authorize a coordinated, governmentwide, scaled-up pre-operational testing program designed to mix and match different technical delivery alternatives, Federal services, and agency partners. Such a program could be funded by reprogramming existing monies. An effective testing program would need top-level support from OMB and the Office of Science and Technology Policy (OSTP), among others, and involvement of some kind of interagency committee to assure agency cooperation.

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[12] OMB could begin by taking an inventory of existing advisory bodies, starting with its own Federal IRM Council (senior agency IRM officials), and including various official and ad hoc interagency advisory and coordinating committees. OMB could review the experience and suggestions of outside advisory groups, including the Center for Information Management operated by the National Academy of Public Administration, the National Institute of Standards and Technology's Computer Systems Security and Privacy Advisory Board, the National Research Council's Computer Science and Telecommunications Board, and the Project Advisory Panels for this and other related Office of Technology Assessment studies. OTA's experience has been that outside advisory groups—properly selected, prepared, and chaired—can be quite helpful. For an example of typical advisory input, see Center for Information Management, National Academy of Public Administration, "The Information Government: National Agenda for Improving Government Through Information Technology," recommendations from a forum of senior government and private sector officials held Apr. 23-24, 1993, and submitted July 15, 1993, to Vice President Gore and the National Performance Review.

[13] EBT has been the most extensively pilot-tested and evaluated electronic delivery alternative; yet even here, many questions remain when moving up to a nationwide scope of operations. See ch. 4 for further discussion.

The testing program would, ideally, preserve ample opportunity for creativity and innovation while looking for opportunities to realize economies of scale and scope. For completeness, the testing program would include: 1) a competitive technology development program (to ensure that the government has the benefit of state-of-the-art technical approaches); 2) an evaluation component (so that the testing results will provide the information needed for decisionmaking); and 3) a policy analysis component (to anticipate policy issues that would need resolution prior to full-scale operational deployment—also see ch. 7 issues discussion). The testing program could begin to show results in a 12- to 18-month timeframe, and perhaps as soon as 6 months for technical applications that have already been well tested.

To get the maximum return on current and new investments in electronic delivery innovation and testing, agencies should share results among themselves and their State/local counterparts. Currently this is a hit or miss process. OTA found that many Federal agency information technology officials are only vaguely aware of what other Federal or State/local agencies are doing with electronic delivery, let alone knowing the results of these efforts. State/local government awareness is, likewise, generally quite limited. The trade and specialty press play a helpful role in sharing results, as do professional associations and conferences focused on government information technology. Federal interagency working groups have proven effective at sharing experience in specific application areas. And some universities have information management or public administration programs that attempt to track Federal and State/local electronic delivery projects. All of these efforts are worthwhile, but leave many gaps in coverage and, more importantly, still fail to reach numerous Federal and State/local information technology personnel.

Congress and the administration could, as part of a broader electronic service delivery innovation initiative, encourage more effective sharing of innovations by:

1. asking one or more appropriate Federal agencies[14] to establish or coordinate, directly or under contract, a clearinghouse for information on electronic delivery innovations and results that is accessible and disseminated to the public electronically (this could include the results of OMB's survey of agency "service to the citizen" projects);[15]
2. requiring electronic service innovators in Federal agencies to provide input to the clearinghouse (reporting on results should be included in all project budgets);
3. encouraging State/local and private sector innovators to provide input to the clearinghouse;
4. asking the National Technical Information Service (NTIS) and Government Printing Office (GPO) to collaborate on how they might provide special directories or bibliographic indices to federally funded electronic delivery projects; and/or
5. providing funding through a designated Federal agency[16] to qualified universities or private sector researchers to conduct periodic

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[14] Candidates might include the General Services Administration, National Institute of Standards and Technology, National Technical Information Service, Government Printing Office, and U.S. Geological Survey, among others.

[15] OMB is not at present well situated or staffed to operate a clearinghouse or directory. OMB's troubled efforts to implement the Federal Information Locator System are instructive.

[16] Such as GSA, NIST, and/or the National Science Foundation.

surveys and syntheses of electronic service delivery projects.[17]

In each of the above, information technology, such as electronic bulletin boards and computer networking, can be used to facilitate exchange of information about innovations. An innovation clearinghouse also should be viewed more broadly as part of the Federal Information Locator System (FILS) concept, mandated by the PRA but as yet not fully implemented. A directory (or family of directories) to Federal services and information, whether called FILS or something else, is essential to effective electronic delivery.[18] Federal directories now can be structured by using wide-area search and retrieval technologies that allow individual agency directories to function collectively as a "virtual" governmentwide directory (see ch. 7 discussion).[19]

An IRM planning and budgeting process re-oriented to electronic delivery needs to integrate all key success factors: grassroots citizen involvement; community infrastructure; innovation; directories; visioning; strategic partnering; and pre-operational testing (with evaluation and policy development components). Collectively, these would constitute the backbone of a governmentwide electronic service delivery initiative. Congress and the administration could provide agencies with guidance or directives on each of the success factors. One possible approach is illustrated in table 6-1. The amount of funds set aside for grassroots involvement, community infrastructure development, and innovation would need to be evaluated periodically; the percentages shown in table 6-1 represent OTA's best judgment of the amount required to make a significant difference.

Strengthened IRM Leadership

Experience indicates that IRM works only if the top-level decisionmakers understand the role of IRM and information technology, and include IRM in the decisionmaking process. In the Federal Government, each agency is required to designate a senior IRM official—typically an assistant or deputy assistant secretary for administration, or equivalent. If information technology and electronic delivery are to be key components of a re-engineered government, then these positions need to be revised as well.

Senior IRM officials provide some high-level visibility for IRM and information technology, but typically have major administrative responsibilities beyond IRM. The senior IRM officials frequently delegate many IRM responsibilities to lower level staff. The problem is compounded if the senior designated official is not "in the loop" on major agency programmatic decisions. Agencies could be required to have a senior official at the level of assistant secretary or assistant bureau chief with full-time IRM responsibilities, and to include that person in top-level planning and decisionmaking on agency programs and service delivery strategies. In private industry, this official is frequently known as the "chief information officer" or CIO and also may serve as a corporate vice president and member of the executive com-

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[17] OTA has funded ad hoc surveys, in the absence of a continuous, sustained survey program funded by the executive branch. For OTA survey results, see, for example, John Harris, Alan F. Westin, and Anne L. Finger, "Innovations for Federal Service: A Study of Innovative Technologies for Federal Government Services to Older Americans and Consumers," contractor report prepared for the Office of Technology Assessment, February 1993; Richard Civille, "Broadening the Research Community: Delivering Federal Services Using Information Technology," contractor report prepared for the Office of Technology Assessment, December 1992; Susan G. Hadden and W. James Hadden, Jr., "Government Electronic Services and the Environment," contractor report prepared for the Office of Technology Assessment, November 1992; William H. Dutton and K. Kendall Guthrie, "State and Local Government Innovations in Electronic Services: The Case in the Western and Northeastern United States," contractor report prepared for the Office of Technology Assessment, Dec. 12, 1991.

[18] Also see Gary D. Bass and David Plocher, "Finding Government Information: The Federal Information Locator System (FILS)," *Government Information Quarterly*, vol. 8, No. 1, 1991, pp. 11–32.

[19] Wide Area Information Servers and Gopher software are two examples of new ways to effectively and quickly search and retrieve information from geographically remote directories. Gopher is capable of finding and accessing databases at participating locations within a second or two anywhere in the United States, and within a few seconds globally (assuming available telecommunication lines and proper technical setup at both ends).

Table 6-1—Illustrative Guidance to Federal Agencies on Electronic Service Delivery

Success factor	Possible congressional or Office of Management and Budget guidance
Grassroots citizen involvement	Required component of all electronic delivery project plans; 0.25% minimum set-aside from agency information technology (IT) budget
Community infrastructure development	Optional component of project plans; but 0.25% minimum set-aside from agencywide IT budget allocated to infrastructure development
Encouraging innovation	Required agencywide program; 0.5% minimum set-aside from agency IT budget; required participation in innovation clearinghouse
Creating directories	Required; each agency to plan and implement directory (or directories) to agency services and information; required participation in governmentwide directory
Creating alternative futures	Required component of agency annual and 5-year Information Resource Management (IRM) plans
Strategic partnering	Required component of agency annual and 5-year IRM plans; optional component of project plans, but must be considered
Pre-operational (pre-op) testing:	Prerequisite for all medium- to large-scale regional or nationwide electronic delivery systems
Pre-op evaluation	Required component of pre-op testing plans; 5% minimum set-aside from pre-op testing budget
Policy development	Required component; 5% minimum set-aside from pre-op budget

SOURCE: Office of Technology Assessment, 1993

mittee. This reflects the dominant corporate view of information technology as a strategic resource. The private sector experience has demonstrated, however, that an effective CIO has strong working relationships with the persons responsible for product development and sales—the "bottom line" activities equivalent to program or service delivery in the government context. Otherwise, the CIO will not be effective.

The Department of Veterans Affairs (VA) has established, in part at the urging of Congress, an intra-agency Council of Chief IRM Officers drawn from the various major VA bureaus. This concept could be replicated at other cabinet departments. Some proposals for elevating the Environmental Protection Agency (EPA) to cabinet status include an assistant secretary-level CIO. Congress could amend the PRA to require that all departments, or perhaps all agencies, have CIOs and that all cabinet departments have "Councils of CIOs or Chief IRM Officers." For the CIO concept to work, each CIO must have the authority and responsibility (and the requisite qualifications and experience) to bridge the all-too-frequent gap between the world of information technology and the world of service delivery. The results of OTA research and site visits, and extensive State/local government experience and academic studies, are clear: successful electronic service delivery requires leadership from persons who understand the technology being applied, the programs being delivered, and the customers or clients.[20]

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[20] See John Leslie King and Kenneth L. Kraemer, "Patterns of Success in Municipal Information Systems: Lessons From U.S. Experience," *Informatization and the Public Sector*, vol. 1, 1991, pp. 21–39; and James L. Perry, Kenneth L. Kraemer, John Leslie King, and Deborah Dunkle, "The Institutionalization of Computing in Complex Organizations," *Informatization and the Public Sector*, vol. 2, 1992, pp. 47–73.

The Federal Government also needs a new IRM training program. State/local and private sector experience with electronic delivery points to the need for a revamped training program as part of successful electronic delivery. Training has come a long way from the days when IRM staff were, quite accurately, equated with automatic data-processing personnel. Only a decade ago, few in-house or outside IRM training programs existed. Now the GSA, U.S. Department of Agriculture (USDA) Graduate School, and numerous academic and commercial education programs offer IRM-related courses. The GSA's "Trail Boss" program to train agency procurement staff and "1,000 by 2000" program to train 1,000 IRM staff by the year 2000 are commendable in spirit. But electronic service delivery is not yet a central focus, and these training programs would need considerable revision to support a new Federal IRM strategy. A conventional IRM approach will no longer suffice.

The Federal IRM leadership could collaborate with its State/local counterparts and academic experts on the development of new training materials and courses. The State of California, for example, has initiated a multiyear plan to retrain and re-educate many of its 7,000 IRM employees, with the objective of redirecting the IRM bureaucracy from an internal to an external electronic service-oriented mission. The training challenge facing the Federal Government is about an order of magnitude greater. Roughly 70,000 Federal employees have primarily computer or communications responsibilities; the total approaches 100,000 if librarians, audio-visual and public affairs specialists, archivists, technical writers, printers, and the like are included. Many of these jobs are going to change in content and responsibilities as the government moves further into electronic delivery activities. Good training can help make the transition as painless and stress-free as possible, and can help improve both productivity and cooperation in IRM operations.

Concepts that warrant emphasis in IRM training programs include:

1. assessing customer or client needs,
2. integrating customer perspectives and needs into electronic service delivery planning from the outset,
3. developing electronic delivery scenarios,
4. revising agency automation and information technology programs to support electronic service delivery,
5. designing electronic service as part of integrated (intra- and interagency) delivery strategies, and
6. managing electronic delivery projects under conditions of rapidly changing technologies and needs.

Information technology managers in the government, as in the private sector, must learn more flexible, adaptable methods to keep projects on track in the face of rapid change. And the training process itself needs to be flexible with use of a wide range of techniques—including small-group seminars, off-site technical training, customer awareness or sensitivity training, hands-on demonstrations, personal computer-based interactive training, distance learning, and training videos.[21]

A new training program is one way to involve the affected Federal labor force in planning and implementation of electronic delivery. Even with the best laid plans and adequate funding, Federal employees will make or break the success of electronic delivery. Knowledgeable and committed employees are essential. The history of government and corporate automation is replete with failures due in part to poorly trained, uninvolved, and sometimes even alienated or hostile employees. OTA commissioned, for example, a case study on integrating information technology and

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[21] For discussion of local government training experiences, see Patricia T. Fletcher, Stuart I. Bretschneider, and Donald A. Marchand, *Managing Information Technology: Transforming County Government* (Syracuse, NY: Syracuse University School of Information Studies, August 1992).

PHOTOS: FRED B. WOOD

Top: *Automated railroad signaling system, Union Pacific Station, Billings, Montana. Modern telecommunication systems are vital to the safe and efficient operation of the Nation's railroads.*

Right: *Microwave relay station in Billings, Montana. The Nation's telecommunications and information infrastructure will be as important to 21st century America as the railroads and highways in the 20th century.*

service delivery at the Social Security Administration. This review of one of the largest and oldest Federal agency automation programs concluded that impacts on the agency labor force must be addressed from the outset; labor must be included as a full partner at all stages of agency automation. Neglect or deferral of labor implications and concerns—especially about job changes or losses—easily can result in much greater costs and problems over the longer term.[22] This will be no less true for electronic service delivery initiatives.

REFOCUSED IRM ORGANIZATION

Congress and the President could use the opportunities presented by electronic service delivery to rethink and possibly reorganize the Federal IRM organization. At present, the executive branch IRM leadership is shared, per the PRA, among the OMB's Office of Information and Regulatory Affairs (OIRA), GSA's Information Resources Management Service (IRMS), and the National Institute of Standards and Technology's (NIST's) National Computer Systems Laboratory (CSL). Other Federal agencies, while outside the formal IRM umbrella, are or could become key policy players in electronic delivery of Federal services. These include the National Telecommunications and Information Administration (NTIA) and the

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[22] Harris, Westin, and Finger, *Innovations for Federal Service*, op. cit., footnote 17. Also see U.S. Congress, Office of Technology Assessment, *Automation of America's Offices*, OTA-CIT-287 (Washington, DC: U.S. Government Printing Office, December 1985); U.S. Congress, Office of Technology Assessment, *The Social Security Administration and Information Technology*, OTA-CIT-311 (Washington, DC: U.S. Government Printing Office, October 1986); and Diana Roose, *High Performance Office Work: Improving Jobs and Productivity* (Cleveland, OH: 9 to 5 Working Women Educational Fund, 1992). Also, OTA has initiated a review of the Social Security Administration's current automation program, at the request of the House Committee on Appropriations; OTA is examining the implications of automation for customer satisfaction, service delivery, and labor force involvement and productivity, among other topics.

White House Office of Science and Technology Policy (OSTP).

OIRA is the lead information policy and budget office for the executive branch; OIRA also has responsibility for reviewing agency information collection requirements, including those associated with proposed regulations. Some IRM experts believe OIRA allocates too many staff to budget and regulatory review at the expense of information policy. Consumer, environmental, and public interest advocates believe OIRA overstepped its mandate when conducting substantive review of agency regulatory proposals, well beyond the information collection implications, and violated due process and open government requirements in doing so. OIRA has, in the past, argued:

1. that its staff gains additional clout by combining the policy analyst and budget examiner roles, which promotes stronger information policy;
2. that the substantive and information requirements of regulatory proposals are frequently inextricably related;
3. that, in any event, OIRA has the authority to conduct substantive regulatory reviews on behalf of the President—whether authorized by the PRA or not; and
4. that such reviews are subject to executive privilege.

The prior administration transferred the more controversial OIRA regulatory activities to a then newly created Council on Competitiveness reporting to the Vice President. The current administration terminated the Council on January 20, 1993.

When reauthorizing the PRA, Congress could clarify OIRA's role regarding substantive regulatory review, and the need for adherence to principles of open government to the maximum extent possible. Congress could further focus OIRA by statutorily defining and limiting substantive regulatory review, possibly even dropping the "R" from OIRA. Congress could refocus the "new" OIRA on information policy, management, and budgetary matters, and more broadly on electronic service delivery initiatives.

Also, Congress could redefine the OIRA role in approving agency information collection requirements to emphasize fundamental reform in agency practices, using electronic delivery to drastically reduce bureaucratic red tape and paperwork, improve productivity, and increase customer satisfaction. The objective could be to orient OIRA much more towards creative, innovative use of electronic technology to meet traditional and new goals. Setting up an "Electronic Service Delivery" branch within OIRA might help. OIRA has not had sufficient staffing and resources to adequately do its information policy job, let alone address electronic delivery, partly because attention has been diverted to regulatory activities and resultant political issues.

GSA's IRMS provides detailed management support and guidance to the agency IRM activities, including assistance with agency planning, management, training, and procurement of computer and telecommunications technologies and systems (including administration of FTS2000). GSA/IRMS issues the delegations of authority for agency procurement and numerous regulations and guidelines on agency IRM activities. GSA/IRMS has sponsored some small electronic service delivery initiatives (e.g., the "Service to the Citizen" program, and the Center for Information Management at the National Academy of Public Administration), but in general has found it difficult to take a leadership role on electronic delivery—even though some GSA/IRMS officials recognize the potential.

The organization and role of GSA in information technology—and, potentially, electronic service delivery—warrant congressional and executive branch review. GSA/IRMS could be split from the rest of GSA (that which deals primarily with the acquisition and management of Federal buildings and supplies) and set up as a separate "Information Resources Agency" or "Electronic Services Agency," or possibly combined with some other existing agency. This might give the

IRM function more visibility and leverage. Alternatively, a new "Assistant Commissioner for Electronic Delivery" or some other high-level organizational unit focused on electronic delivery could be established within IRMS. But whatever the organizational locale, a rethinking of GSA/IRMS is in order. GSA/IRMS needs to create a new vision of its role in electronic service delivery, and critically review its priorities and resource allocation against that vision. Staff may need to shift their focus from what many agency IRM staff believe is an excessive involvement with the minutia of IRM to greater attention to strategic thinking, visioning, planning, and training for electronic service delivery.

The GSA/IRMS field structure around the Nation is a potentially valuable asset for Federal/State/local information-sharing and collaboration on electronic service delivery. But the field structure needs to be re-energized—and probably reorganized and retrained—both to work with the Washington headquarters around a common vision, and to reach out more effectively to State/local government and private sector electronic delivery innovators and activists. Each GSA/IRMS regional and State office could be required to have an electronic service delivery coordinator.

A revitalized OMB/OIRA and GSA/IRMS could, in addition to current responsibilities, take more aggressive action on:

- *Intelligent buildings*—by adopting "smart office" or "intelligent office" prototypes that support a wide range of computer and telecommunications applications, including electronic delivery, without having to endlessly rewire at substantial cost;
- *Telecommuting*—by building on current "flexiplace" and "telework" programs that are demonstrating the energy, environmental, and quality of work and family life benefits when carefully planned and implemented;
- *Energy efficient electronic delivery*—by building on current efforts to reduce the energy consumption of computers, peripheral equipment, and networks used by the Federal Government;
- *Electronic commerce*—by extending the Department of Commerce's "Electronic Commerce 2000" program—designed to automate all business transactions (filings, billings, applications, data reporting, etc.) with the department by the year 2000—to all Federal departments and agencies with the goal of drastically reducing paperwork;
- *Electronic government*—by extending OMB's recent requirement that agencies use electronic mail for exchange of internal memos, documents, drafts, testimony, and the like to all internal government information, using appropriate technology and making provision for full compliance with open government, public access, and record archiving requirements (see ch. 7); and
- *Re-engineering government*—by developing "InfoFED," "FedServe," "Federal Buddy," and other prototypes based on agency efforts to fundamentally rethink how they deliver services, such as the USDA's "Easy Access" and "InfoShare" programs to deliver multiagency services over a common set of technology platforms or points of access (kiosks, smart cards, computer networks, Cooperative Extension Service offices, etc.) (see table 6-2 for other examples).

NIST also has a significant role in governmentwide IRM leadership, and potentially in electronic service delivery. The NIST Computer Systems Laboratory (CSL) is responsible for: 1) policy development and oversight of computer and communications security in the civilian agencies; 2) promulgation of technical standards on a wide range of information technology and systems used by Federal agencies (as part of public-private standards-setting processes); and 3) management of technology laboratories, demonstrations, and conferences related to Federal information systems.

NIST/CSL could establish a new "electronic service delivery laboratory" that focuses on technology and standards development relevant to electronic delivery. A new NIST "electronic delivery lab" could be colocated with GSA/IRMS or with a newly established "Information Resources or Electronic Delivery Agency." This would improve integration of policy, management, and technical perspectives, but, on the other hand, would remove the lab from the otherwise compatible standards and technology environment at the main NIST facility in Gaithersburg, Maryland. Alternatively, NIST could set up the lab in Gaithersburg, but also operate a satellite mini-lab at the downtown GSA building (or at the Department of Commerce headquarters building), readily accessible to staff from OMB/OIRA, GSA/IRMS, and other agencies. This could be supplemented by computer conferencing and videoconferencing between Gaithersburg and Washington, DC.

OSTP has statutory responsibilities for scientific and technical information dissemination, unaddressed until recently,[23] and in the last few years has provided coordination for the Federal high-performance computing and networking initiative. OSTP has a lead role in carrying out the President's technology policy. The policy gives high priority to development of the national information infrastructure for economic stimulus, jobs creation, education and training, international competitiveness, science and engineering leadership, and a more productive and responsive government. Thus OSTP has a logical role in governmentwide electronic delivery initiatives, both because the information infrastructure is a primary vehicle for Federal electronic delivery across the board, and because the Federal science and technology agencies will be heavily involved in electronic delivery of their own services.

NTIA, located in the Department of Commerce as is NIST/CSL, has statutory responsibilities for

TELECOMMUTING
WORK CENTER
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PHOTOS: FRED B. WOOD

Top: *The Telecommuting Work Center in Riverside, California, provides employees from participating organizations with complete office facilities, including telephone, facsimile, computer, and duplication services.*

Bottom: *The Telecommuting Work Center is intended to significantly reduce the time, money, congestion, and pollution associated with the long commute distances typical of Southern California.*

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[23] Prior to this administration, OSTP has been remiss in carrying out its statutory responsibilities for scientific and technical information. See U.S. Congress, Office of Tecnhnology Assessment, *Helping America Compete: The Role of Federal Scientific and Technical Information,* OTA-CIT-454 (Washington, DC: U.S. Government Printing Office, July 1990); and Fred B. Wood, "Helping America Compete Through More Effective Use of Scientific and Technical Information: An Opportunity for Office of Science and Technology Policy Leadership," *Government Information Quarterly,* vol. 8, No. 1, 1991, pp. 105–112. H.R. 1757, the National Information Infrastructure Act of 1993, approved by the House on July 20, 1993, and S. 2 Title VI, the Information Technology Applications Act of 1993, reported out of committee on May 25, 1993, would strengthen and broaden the OSTP role in electronic delivery of educational, health care, library, and information services over computer networks. Also see Information Infrastructure Task Force, "The National Information Infrastructure: Agenda for Action," National Telecommunications and Information Administration, Washington, DC, Sept. 15, 1993.

Table 6-2—Illustrative Prototypes of Re-Engineering Government Through Information Technology

Federal agency	Prototype applications
Department of Veterans Affairs	Plans to use electronic data interchange (EDI) for processing client histories, purchase orders, claims and payments for health care providers and insurers, mortgage applications for lenders, etc.; expected to cut processing costs in half
Department of Agriculture (USDA)	Plans one-stop electronic shopping for services from multiple USDA agencies, e.g., Rural Development Administration, Soil Conservation Service, Farmers Home Administration, Extension Service
Internal Revenue Service	Plans all-out push for widespread electronic filing to reduce paperwork, errors, and cost through telephone filing (touchtone plus voice or identifier recognition), PC filing, joint Federal/State electronic filing, and third-party filing
Securities and Exchange Commission	Under pressure to provide computer network (including Internet) access to EDGAR, a public database of corporate financial and business information
Environmental Protection Agency (with U.S. Army)	Provides on-line computer access to the EnviroText database of Federal/State environmental laws and regulations
Environmental Protection Agency	Plans extensive use of EDI for monitoring hazardous waste shipments, water discharges, and smokestack emissions
Census Bureau	Plans use of pen computers, by year 2000, for census-takers
Food and Drug Administration	Could include filing by computer as well as by mail, fax, or phone for physician reporting of drug and medical device side-effects to the MEDwatch database
Department of Housing and Urban Development	Plans extensive use of EDI for processing mortgage insurance claims from over 13,000 lenders
Food and Nutrition Service	Plans nationwide implementation of magnetic stripe card for issuing food stamp benefits
White House Health Care Reform Task Force	Plans to recommend nationwide implementation of a "Health Passport" card as part of the health care reform package

SOURCE: Office of Technology Assessment, 1993.

technical and policy analyses on Federal spectrum management, national information and telecommunications issues, government communications, and a public telecommunications grant program. NTIA was created in 1978 by combining most of the former White House Office of Telecommunications Policy with the Commerce Department's pre-existing Office of Telecommunications. With few exceptions, NTIA has focused primarily on telecommunications policy and has done little on national information policy.[24] This will change, however, since NTIA is to administer information networking pilot projects (matching grants to States, schools, and libraries) called for in the President's technology policy, and is participating in national information infrastructure activities. The networking pilot projects certainly could involve electronic delivery of services, and NTIA's general charter would suggest a broader role in electronic service delivery initiatives.

Strengthening the "I" in NTIA would require top-level management support (both within the Department of Commerce and at the White House), increased resources (perhaps in part through reallocation of existing NTIA funds and staff), strong NTIA leadership on the importance of information policy, and probably some degree of organizational and staff changes or restructuring within NTIA.

In sum, there is a need to rethink traditional IRM and the relationships between IRM, electronic service delivery, and the national information infrastructure. This could include a review of how the traditional IRM organizations at OMB, GSA, and NIST—and their counterparts in the mission agencies—can work better together and with others, like OSTP and NTIA. The review could extend to other Federal agencies that have a role in electronic service delivery, such as the National Archives and Records Administration, Consumer Information Center, and Depository Library Program (see ch. 7). The Office of the Vice President could provide a focal point for rethinking IRM, since information technology and electronic service delivery are central to both the administration's "National Information Infrastructure" (NII) and "National Performance Review" (NPR) initiatives. Electronic service delivery is also germane to various proposals for outside study commissions on reinventing or rethinking the Federal Government's organization for the 21st century.[25]

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[24] The two major NTIA analytical contributions over the last decade were *NTIA Telecom 2000: Creating the Course for a New Century,* NTIA Special Publication 88-21 (Washington, DC: U.S. Department of Commerce, October 1988), and *The NTIA Infrastructure Report: Telecommunications in the Age of Information,* NTIA Special Publication 91-26 (Washington, DC: U.S. Department of Commerce, October 1991). These NTIA reports gave some attention to information issues, but the primary focus was on telecommunications infrastructure trends and issues. For contrasting approaches, see U.S. Congress, Office of Technology Assessment, *Critical Connections: Communication for the Future,* OTA-CIT-407 (Washington, DC: U.S. Government Printing Office, January 1990) and *Informing the Nation: Federal Information Dissemination in an Electronic Age,* OTA-CIT-396 (Washington, DC: U.S. Government Printing Office, October 1988).

[25] See H.R. 1091, a bill to establish the Commission on Information Technology and Paperwork Reduction, Feb. 24, 1993; S. 15, the Reinventing Government Act, Jan. 21, 1993; and S. 101, the Executive Organization Reform Act of 1993, introduced Jan. 21, 1993, and reported out by the Senate Committee on Governmental Affairs on Aug. 5, 1993. Also see Vice President Gore, op. cit., footnote 5; and Information Infrastructure Task Force, op. cit., footnote 23.

Information Policies for Electronic Service Delivery

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SUMMARY

Most Federal information policies either predate the electronic era or reflect, at best, the period when expensive mainframe computers dominated agency automation and telecommunications meant "plain old telephone service." The policymaking process has lagged technological advances and new applications by several or more years. Electronic service delivery provides a framework for balancing the reality of decentralized, dispersed, user-oriented agency automation with the need for some measure of centralized, yet flexible, policy direction and oversight.

The transition to electronic delivery of many Federal services will require the review and updating of most Federal information policies. Congress can play a central policymaking role in assuring that electronic delivery develops in ways that maintain or enhance: equity of access to Federal services; open government; confidentiality and integrity of service delivery; and fair and effective competitive procurement.

Perhaps the greatest challenge will be assuring equitable access to Federal services in an electronic environment. This will require both the kinds of management, planning, partnering, and budgeting actions discussed in chapter 6 and the various policy actions discussed here. To have meaningful electronic access, citizens need to know what services exist and how to obtain them, and they must be able to make the electronic connections necessary to receive the services at an affordable price. The Office of Management and Budget's (OMB) recently revised Circular

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A-130 on "Management of Federal Information Resources" provides new guidance on many policies relevant to equitable access, such as directories, pricing, and use of depository libraries.[1] Congress could review the revised A-130 and determine which provisions warrant statutory treatment or fine-tuning to reinforce and clarify legislative intent.

Electronic delivery should provide many opportunities to improve citizen access not only to agency-specific mission-oriented services, but to the processes of government (e.g., hearings and rulemakings). The long-standing congressional commitment to open government is reflected in several statutes, such as the Freedom of Information Act, Federal Records Act, Government in the Sunshine Act, and Federal Advisory Committee Act. Congress could review and update open government statutes to clarify their applicability to electronic services and activities, and emphasize the appropriate use of information technology. Congress could require that governmental process information—for example, information on hearing schedules or opportunities for public comment or input—for both the executive and legislative branches be provided via electronic as well as conventional means.

Widespread electronic delivery of services that involve personal or financial information will create new privacy and security risks and accentuate the need for stronger safeguards. Congress could review and update the Privacy Act, Computer Security Act, and related statutes to help ensure the confidentiality and integrity of electronic delivery. Congress also could direct OMB and the National Institute of Standards and Technology (NIST) to conduct a privacy/security review of electronic delivery initiatives. Congress could extend the scope of the Privacy Act to include private sector systems used in electronic delivery, and establish a permanent, independent Privacy Protection Commission or Board to help assure protection of personal information used in electronic delivery.

Electronic delivery also will intensify the need to clarify Federal policy on contracting for information technologies and services. Congress could review the revised OMB Circular A-130, any proposed revisions to OMB Circular A-76 on "Performance of Commercial Activities," and Federal procurement statutes to help assure an appropriate balancing of the sometimes competing considerations related to electronic delivery: public accountability; equity of access; government efficiency; public/private sector cooperation; and equity of competition (a "level playing field"). Absent improvements in procurement practices, major contracting for electronic service delivery could further strain a Federal procurement process that is already overly complicated, lengthy, rigid, expensive, and inefficient.

Congress could review and update information policies individually, in groups, or as part of a comprehensive package. The reauthorization of the Paperwork Reduction Act[2] (PRA) could be used as a vehicle, as could new legislation such as a "Federal Information Management Act" or "Electronic Service Delivery Act" that might supplement or supersede the PRA. Congress could encourage or require that OMB and individual agencies explicitly address these policy areas early in the demonstration and pre-operational stages of electronic delivery projects, and when considering information technology as a part of agency reorganization. Implementation of electronic delivery would, in many cases, require revision of public laws that establish and define the services being delivered.[3]

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[1] See Office of Management and Budget, Circular A-130 Revised, "Management of Federal Information Resources," *Federal Register,* vol. 58, No. 126, July 2, 1993, pp. 36068-36086.

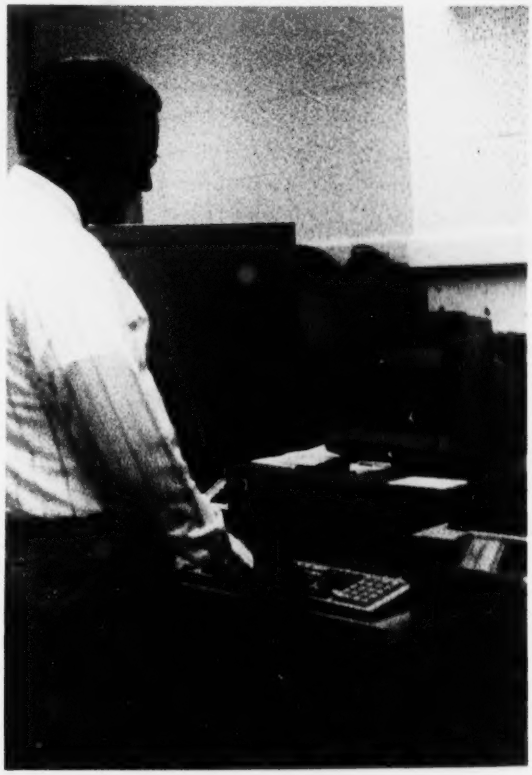
[2] The Paperwork Reduction Act of 1980, Public Law 96-511, was amended once by the Paperwork Reduction Reauthorization Act of 1986, Public Law 99-500. The reauthorization was for 3 years. Subsequent efforts to reauthorize and further amend the Act have not, as yet, reached fruition, but are continuing in the 103d Congress. See S. 681, the Paperwork Reduction Reauthorization Act of 1993, Mar. 31, 1993; S. 560, the Paperwork Reduction Act of 1993, Mar. 10, 1993; and H.R. 2995, the Paperwork Reduction Act of 1993, Aug. 6, 1993.

Congress could consider policy revisions in the context of proposals from the administration's technology policy, performance review, and information infrastructure initiatives. The administration's technology policy asserts that, to make government work better through information technology, "[m]any of the government's policies in such areas as privacy, information security, records management, information dissemination, and procurement will be updated to take into account the rapid pace of technological change."[4]

PROTECTING PRIVACY AND SECURITY

The Federal Privacy Act is intended to protect personal information maintained by the government from inappropriate or unauthorized disclosure and use.[5] The original Privacy Act was passed in the early days of agency automation, before microcomputers or widespread electronic networking. Congress has modestly updated the Act to address applications such as computer matching (the electronic comparison of lists of persons receiving different benefit programs to help detect fraud, waste, and abuse).[6]

The pressure to match computer lists of government aid recipients against computerized tax, social security, medical, veterans, and other files seems relentless. The social security number has become a de facto national identifier, although this



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The use of optical disks makes gigabytes of driver's license information available in seconds to State of Washington officials. The technology permits improved service to the citizens of Washington State, but also increases the need for protection of the privacy and security of personal information stored in State data banks.

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[3] For a broad overview, see Charles R. McClure, Rolf T. Wigand, John Carlo Bertot, Mary McKenna, William E. Moen, Joe Ryan, and Stacy B. Veeder, Syracuse University School of Information Studies, "Federal Information Policy and Management for Electronic Services Delivery," contractor report prepared for the Office of Technology Assessment, Dec. 21, 1992.

[4] President William J. Clinton and Vice President Albert Gore, Jr., "Technology for America's Economic Growth: A New Direction To Build Economic Strength," Feb. 22, 1993. Also see Vice President Al Gore, *Creating a Government That Works Better and Costs Less: Report of the National Performance Review* (Washington, DC: U.S. Government Printing Office, Sept. 7, 1993). One of the National Performance Review's crosscutting task forces focused on re-engineering the Federal Government through information technology. See National Performance Review Accompanying Report, *Reengineering Through Information Technology* (Washington, DC: U.S. Government Printing Office, September 1993), and the closely related Information Infrastructure Task Force, "The National Information Infrastructure: Agenda for Action," National Telecommunications and Information Administration, Washington, DC, Sept. 15, 1993. Also, improving the delivery of Federal services is within the scope of the proposed National Commission on Executive Organizational Reform. See S. 101, the Executive Organization Reform Act of 1993, introduced Jan. 21, 1993, and reported out by the Senate Committee on Governmental Affairs on Aug. 5, 1993. Recently enacted legislation will require Federal agencies to establish clear goals against which performance of agency activities—including service delivery—can be measured. See the Government Performance and Results Act of 1993, Public Law 103-62.

[5] Privacy Act of 1974, Public Law 93-579.

[6] Computer Matching and Privacy Protection Act of 1988, Public Law 100-503; Computer Matching and Privacy Protections Amendments of 1990, Public Law 100-503.

use is technically prohibited by law.[7] And extensive computer matching can lead to a "virtual" national data bank, even if computer records are not physically centralized in one location.[8] Widespread use of 1-800 and 1-900 telephone numbers, combined with caller ID, has created new avenues for unintentional disclosure of personal information. By combining information from computerized credit, census, marketing, change-of-address, and mailing-list files, private companies can construct de facto personal profiles on individuals that are amazingly accurate.[9]

Privacy advocates believe that stronger privacy safeguards are needed to deal with current computer applications, and with new electronic service delivery applications. Electronic delivery of services that involve personal information will create new privacy risks and require stronger protections. Widespread electronic benefits transfer could mean that eligibility and payments information moves over a variety of electronic networks involving banks, retailers, clearinghouses, and the like, in addition to the government agencies already involved.[10] "Smart" cards could include a wide range of personal information. Use of kiosks or electronic filing to determine eligibility for Federal benefits could cut red tape and costs, but would create new opportunities for third-party abuse of personal information.

Computer networking, electronic kiosks, or interactive television, if used to request government services or information, create the potential to monitor citizen preferences. Profiles of citizens' interests compiled from information provided to a kiosk could be valuable for marketing purposes, for example, just as retail purchasing patterns are used to generate commercial mailing lists. Electronic delivery could increase opportunities for commercial "information brokers" to obtain personal information through legal and illegal means.[11] It also could further weaken the ability of individuals to control the use of personal information, and could violate principles of fair information practice.[12]

Fortunately, electronic technology could also be used to protect privacy. Electronic delivery could, for example, allow individuals to access personal information maintained in government record systems, check its accuracy, request corrections, and monitor their records to make sure the corrections are made. Electronic mail or electronic data interchange could provide the opportunity for individuals to give informed consent prior to secondary use of personal information. Today, few people know how to exercise their legal rights to request copies of personal information stored in government or private sector record systems. Few even know where such personal information is stored or what uses are being made of the information. Existing or new technological applications rarely focus on protection of personal privacy. Intentionally or not, government and commercial interests usually take precedence over the privacy rights of individuals.

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[7] The U.S. Court of Appeals for the Fourth Circuit recently voided the Commonwealth of Virginia's requirement that voters' social security numbers (SSNs) be recorded and made publicly available, noting concern over the potential use of SSNs for unauthorized access to personal information. See *Marc A. Greidinger v. Bobby Ray Davis, et al.*, USCA-4, No. 92-1571, Mar. 22, 1993.

[8] See U.S. Congress, Office of Technology Assessment, *Electronic Record Systems and Individual Privacy*, OTA-CIT-296 (Washington, DC: U.S. Government Printing Office, June 1986); and U.S. Congress, Office of Technology Assessment, *Privacy Rights in Computerized Medical Information*, forthcoming, 1993.

[9] See also U.S. Congress, House, Committee on Government Operations, Subcommittee on Government Information, Justice, and Agriculture, *Give Consumers a Choice*, H.Rep. 102-1067, 102d Cong., 2d Sess. (Washington, DC: U.S. Government Printing Office, December 1992).

[10] See ch. 4 and U.S. Congress, Office of Technology Assessment, *Electronic Delivery of Public Assistance Benefits: Technology Options and Policy Issues*, OTA-BP-CIT-47 (Washington, DC: U.S. Government Printing Office, April 1988).

[11] See U.S. Congress, House, Committee on the Judiciary, Subcommittee on Constitutional and Civil Rights, *Sale of Criminal History Records, Hearing*, 102d Cong., 2d Sess. (Washington, DC: U.S. Government Printing Office, July 30, 1992), that discusses how private companies can obtain credit, social security, employment, driver's license, criminal history, and other personal information on most U.S. citizens—sometimes using illegal methods.

[12] See U.S. Congress, Office of Technology Assessment, *Individual Privacy*, op. cit., footnote 8.

Public opinion surveys continue to indicate that Americans place high value on privacy of personal information, and have little confidence in the privacy of computerized records.[13] To prevent further erosion of individual privacy, new privacy rules would be needed to define appropriate use of personal information associated with electronic service delivery. Key principles could include the right of individuals to:

- know about electronic delivery systems that include personal information and how these systems and information will be used;
- have the opportunity to give prior informed consent regarding all uses and disclosures of personal information in electronic delivery systems;
- have access to and review personal information in such systems;
- correct erroneous information; and
- seek redress before an ombudsman or citizen advocate in the event of any alleged abuse, misuse, or uncorrected error.

To the extent that electronic delivery involves public-private partnerships, the Federal Privacy Act may need to be extended to cover related private sector activities. When electronic delivery involves State or local government participation, then applicable State privacy laws also may need to be amended and strengthened. The magnitude of the potential privacy threat may be great enough to warrant consideration of stronger privacy oversight than exists today. Privacy advocates have long argued for establishment of an independent Federal Privacy Protection Commission or the equivalent.[14] The Computer Matching and Privacy Protection Act did require each Federal agency to set up a so-called Data Protection Board to review and monitor agency computer matching projects, but these Boards are comprised of current agency officials just wearing another hat, and are not truly independent. Congress could strengthen these Boards and provide them with more independence and separate staff, along the lines of the agency inspectors' general offices.

OMB's Office of Information and Regulatory Affairs provides privacy oversight that is independent of the line agencies, but it is still subject to the value judgments and policies of the administration in power. The same is true for the Office of Information and Privacy in the U.S. Department of Justice. As an alternative, a Federal Privacy Protection Commission could serve as:

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[13] Ibid., and Office of Technology Assessment, *Privacy Rights*, op. cit., footnote 8. Several earlier OTA studies also highlighted the importance of privacy issues. See U.S. Congress, Office of Technology Assessment, *Computer-Based National Information Systems: Technology and Public Policy Issues*, OTA-CIT-146 (Springfield, VA: National Technical Information Service, September 1981); U.S. Congress, Office of Technology Assessment, *Selected Electronic Funds Transfer Issues: Privacy, Security, and Equity*, OTA-BP-CIT-12 (Springfield, VA: National Technical Information Service, March 1982); U.S. Congress, Office of Technology Assessment, *Implications of Electronic Mail and Message Systems for the U.S. Postal Service*, OTA-CIT-183 (Springfield, VA: National Technical Information Service, August 1982); and U.S. Congress, Office of Technology Assessment, *Alternatives for a National Computerized Criminal History System*, OTA-CIT-161 (Springfield, VA: National Technical Information Service, October 1982). Also see discussion of privacy issues in U.S. Congress, Office of Technology Assessment, *Automated Record Checks of Firearm Purchasers: Issues and Options*, OTA-TCT-497 (Washington, DC: U.S. Government Printing Office, July 1991); and U.S. Congress, Office of Technology Assessment, *The FBI Fingerprint Identification Automation Program: Issues and Options*, OTA-BP-TCT-84 (Washington, DC: U.S. Government Printing Office, November 1991). Numerous public and private groups involved in the development of a national information infrastructure have identified privacy as a priority concern. H.R. 1757, the National Information Infrastructure Act of 1993, approved by the House on July 26, 1993, identifies privacy and security of networked transmissions as one of several priorities. Also see Information Infrastructure Task Force, op. cit., footnote 4.

[14] Canada, Australia, and several Western European nations have privacy commissions or boards. Proposals for a U.S. privacy or data protection board date to 1974, when Senator Sam Ervin proposed a Federal Privacy Board to complement the Privacy Act of 1974. Legislation to establish a privacy board or commission has been introduced in the last six U.S. Congresses. See H.R. 3743, the Privacy Protection Act of 1984, Aug. 2, 1983; H.R. 296, the Consumer Privacy Protection Act, Jan. 3, 1985; H.R. 1721, the Data Protection Act of 1985, Mar. 26, 1985; H.R. 638, the Data Protection Act of 1987, Jan. 21, 1987; H.R. 1549, the Individual Privacy Protection Act of 1987, Mar. 11, 1987; H.R. 126, the Individual Privacy Protection Act of 1989, Jan. 3, 1989; H.R. 3669, the Data Protection Act of 1989, Nov. 15, 1989; H.R. 280, the Individual Privacy Protection Act of 1991, Jan. 3, 1991; H.R. 685, the Data Protection Act of 1991, Jan. 29, 1991; and H.R. 135, the Individual Privacy Protection Act of 1993, Jan. 3, 1993.

1. a focal point for citizen input and views on privacy matters (using electronic technology where appropriate, such as 1-800 numbers, electronic mail, and computer networking);
2. an ombudsman for citizens with privacy concerns;
3. an overseer of agency (and, prospectively, private sector) compliance with existing laws and regulations;
4. an investigator of alleged violations; and
5. an advocate for new or stronger laws when needed.

Congress could establish a Privacy Protection Commission or Board as an independent agency of the executive branch, or as a component of any Federal Information Management or Electronic Service Delivery agency that might be created. Since privacy and security are closely linked, Congress could include security within the mission of any Commission or Board—for example, a Federal Privacy and Security Protection Board.

Whether under the current or new institutional arrangements, Congress and the administration could require:

1. explicit early consideration of privacy threats and protection by each agency planning electronic delivery;
2. a fresh round of up-to-date training for agency privacy specialists;
3. advance public notice of any privacy implications to clients of electronic delivery programs; and
4. agency workshops, forums, and communication with privacy advocates on the topic of electronic delivery and individual privacy.

Congress also could enact or update privacy statutes in specific programmatic areas where electronic delivery is likely, such as welfare, education, and health care.[15]

The 1980s were marked by growing public and congressional concern about the security of computer and communication systems.[16] Congress enacted the Computer Security Act in 1987 to improve security oversight and safeguards for Federal computer systems.[17] Paperwork Reduction Act amendments strengthened computer security management. The Electronic Communications Privacy Act of 1986 tightened legal protections against unauthorized interception of telecommunications and electronic mail.[18] The Computer Security Act assigns NIST the lead role for the technical aspects of computer security in Federal civilian agencies (the National Security Agency (NSA) has a comparable role for defense agencies). The PRA assigns OMB and the General Services Administration oversight responsibility for Federal civilian agency computer security, including technical and management actions, training, and audits to enhance security. The PRA also requires that computer security be addressed in agency information technology plans.[19]

Widespread electronic service delivery will increase the security risks. Valuable personal, financial, and government data will flow over a complex web of telecommunication networks technically accessible via an ever-growing number of computers, kiosks, and other terminals attached to the networks. Stand-alone units—such as kiosks located in malls—will represent new targets of opportunity for vandalism and robbery, along with automated teller machines (ATMs) and point-of-sale (POS) terminals. Electronic benefit transfers will be vulnerable to sophisticated white-collar computer crime, just as electronic funds transfer (EFT) is today. The information flow in an electronic world is, in general, more vulnerable to deliberate or accidental alteration and interception. The risks are further compounded because erroneous information can be rapidly disseminated over electronic networks and become accessible to large numbers of persons and organizations. Security in a networked environment poses very real and substantial challenges.[20]

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[15] For an up-to-date general discussion, see Office of Technology Assessment, *Privacy Rights in Computerized Medical Information*, forthcoming, 1993.

[16] See U.S. Congress, Office of Technology Assessment, *Electronic Surveillance and Civil Liberties*, OTA-CIT-293 (Washington, DC: U.S. Government Printing Office, October 1985); *Federal Government Information Technology: Management, Security, and Congressional Oversight*, OTA-CIT-297 (Washington, DC: U.S. Government Printing Office, February 1986); *Defending Secrets, Sharing Data: New Locks and Keys for Electronic Information*, OTA-CIT-310 (Washington, DC: U.S. Government Printing Office, October 1987); *Critical Connections: Communication for the Future*, OTA-CIT-407 (Washington, DC: U.S. Government Printing Office, January 1990).

[17] Computer Security Act of 1987, Public Law 100-235.

[18] Electronic Communications Privacy Act of 1986, Public Law 99-508.

[19] As specified in amendments included in the Paperwork Reduction Reauthorization Act of 1986, Public Law 99-500.

It may be possible to keep computer security problems at an acceptable level, as is the case with commercial EFT and ATM and POS terminals. But this will require that Federal agencies and others participating in electronic delivery of Federal services give as much attention to security as do banks and financial institutions, especially where money or personal information are involved.

Congress and the administration could review the applicability of the Computer Security Act, Electronic Communications Privacy Act, and Computer Fraud and Abuse Act to electronic service delivery, and make whatever changes are needed to help ensure secure electronic delivery.[21] This might include extending some legal protections and security requirements from Federal agencies and users to all organizations that participate in electronic delivery. Also, electronic delivery inevitably will be affected by the ongoing debates over: 1) the roles of NIST and NSA in oversight of computer and communication systems in Federal civilian agencies; 2) selection of encryption technologies;[22] and 3) tensions between privacy, personal or organizational security, national security, and law enforcement interests.[23] Legal disputes over the applicability of privacy and security statutes to electronic mail only foreshadow the debates likely to ensue with growth of electronic delivery.[24]

A security risk analysis should be an integral part of electronic delivery planning. The analysis should examine the technical, physical, human, and organizational threats and protections to electronic services. Electronic delivery will only be as secure as its weakest link; if security is lax at end-user terminals, for example, tight security at the sending agency will be meaningless. OMB Circular A-130 could be further revised to focus attention on the security of electronic delivery systems.[25] In the 1993 Information Resources Management (IRM) planning bulletin, OMB asks agencies to report on improvements in systems security, security awareness and training programs for personnel, and agency-wide security upgrades resulting from internal or external audits or reviews.[26] OMB could, in the future, direct agency attention to the linkages between agency security activities and electronic service delivery initiatives, and require more complete monitoring and reporting of security breaches.

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[20] A new Office of Technology Assessment study will focus on privacy and security in a networked computer environment. Also see U.S. Congress, Office of Technology Assessment, *Accessibility and Integrity of Networked Information Collections*, BP-TCT-109 (Washington, DC: U.S. Office of Technology Assessment, July 1993).

[21] The U.S. Department of Justice, for example, is considering possible revisions to the Computer Fraud Act, including forfeiture of computers used in criminal activities, criminalization of intentionally planting computer viruses, and stiffer penalties for computer crimes that invade personal privacy or threaten national security.

[22] The debate over the proposed key escrow chip, known as the "clipper chip," for encryption has heightened concerns among civil liberty and privacy advocates, and some in private industry, about potential government abuse. Law enforcement and national security agencies seek to maintain their technical ability to intercept even encrypted systems when necessary to carry out their agency missions.

[23] For historical background, see Office of Technology Assessment, *Electronic Surveillance*, op. cit., footnote 16; Office of Technology Assessment, *Electronic Record Systems and Individual Privacy*, op. cit., footnote 8; and Office of Technology Assessment, *Defending Secrets, Sharing Data*, op. cit., footnote 16. By presidential order, an interagency task force is reviewing the current Federal system for classifying, safeguarding, and declassifying information. See Information Security Oversight Office, U.S. General Services Administration, "Hearing: Changes to the Security Classification System," *Federal Register*, vol. 58, No. 96, May 20, 1993, p. 29480.

[24] See, for example, the controversy surrounding U.S. Secret Service efforts to monitor electronic mail and bulletin boards used by computer hackers.

[25] Office of Management and Budget, Circular No. A-130 Revised, op. cit., footnote 1.

OPEN GOVERNMENT

The longstanding congressional commitment to open government is reflected in the Freedom of Information Act (FOIA), Government in the Sunshine Act, and Federal Advisory Committee Act.[27] The intent of these statutes is to ensure that the processes and substance of the Federal Government are open and accessible to the American people. Electronic technology can substantially improve public access and reduce the cost of access, under the general rubric of electronic service delivery. But there is no guarantee that this will happen. The governmentwide access statutes do not explicitly address electronic applications, thus

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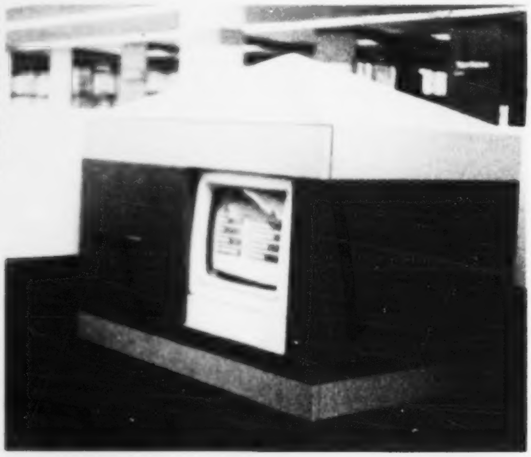

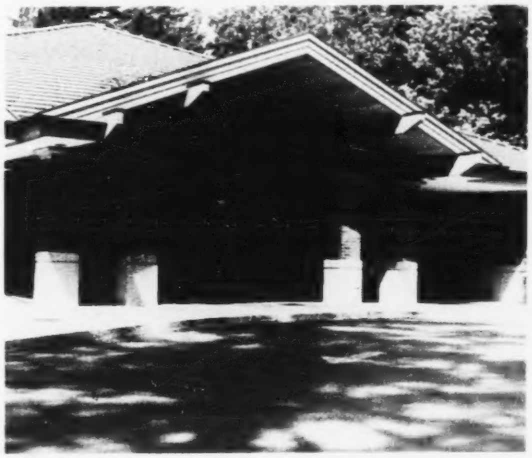

Top left: *Island Epicenter touchscreen kiosk located in the Mercer Island Public Library, Washington State.*

Top right: *Mercer Island Public Library, a place for community access to electronic information services.*

Bottom left: *Microcomputers available for public use in the Mercer Island Public Library, Washington State.*

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[26] Office of Management and Budget, "Information Resources Management (IRM) Plans Bulletin," OMB Bulletin No. 93-12, Apr. 28, 1993.

[27] Freedom of Information Act of 1966, Public Law 89-487; Government in the Sunshine Act of 1974, Public Law 94-409; Federal Advisory Committee Act of 1972, Public Law 92-463.

leaving agencies considerable discretion. Congress could review and revise each of these statutes to reflect advances in technology.

The pros and cons of updating FOIA have been debated for several years. Opponents emphasize that FOIA applies to Federal information regardless of format, and that judicial and administrative interpretations are clearly moving in this direction—thereby lessening the need to amend the Act. Opponents also are concerned that opening FOIA up to amendment might lead to unintended, regressive provisions. Proponents believe that the law leaves too much discretion to executive agencies, leads to unnecessary disagreements over what should be accepted as basic principles (e.g., over the FOIA status of agency electronic mail), and results in many lost opportunities to use technology to improve access to information.

OTA's prior work concluded that new electronic applications were likely to overtake FOIA.[28] The transition to electronic service delivery will surely exacerbate problems and increase lost opportunities if FOIA is not updated. Kiosks and home or office computer terminals offer great potential for remote electronic access to FOIA material kept in Federal agencies, as do off-line digital formats like compact optical disks. Electronic technology offers the potential to greatly reduce the costs of FOIA access for both citizens and Federal agencies. Copying paper documents is costly and cumbersome by comparison. Agencies need to design their automation programs to both facilitate FOIA access and tightly control access to private, proprietary, national security, and other exempted information.

Various researchers and advocacy groups alike have reaffirmed the applicability of FOIA to electronic information. Most support the following principles, and their enactment into law if necessary to assure agency compliance:[29]

- Federal agencies should provide information in any format in which it exists;
- information maintained in electronic format is fully covered by FOIA;
- when providing information in electronic formats, Federal agencies should include any manuals or software necessary for the retrieval and use of the information; and
- when responding to FOIA requests for electronic formats, Federal agencies should use the format requested if it already exists or can be generated with reasonable effort using existing software and equipment.

To complement an updated FOIA, or as an alternative, Congress could replicate the statutory approach used in the "community right-to-know" provisions of the Superfund Amendments and Reauthorization Act of 1986. Title III mandated public access to toxic waste information, known as the "Toxic Release Inventory," in several formats—including electronic.[30] The basic premise is that electronic technology can improve public access to information collected or developed by Federal agencies—if agencies plan for and include these capabilities in their electronic delivery and automation programs. Congress could develop a standard "community or public right to know" provision that could be added to agency or program-specific statutes as they come up for reauthorization.

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[28] See U.S. Congress, Office of Technology Assessment, *Informing the Nation: Federal Information Dissemination in an Electronic Age*, OTA-CIT-396 (Washington, DC: U.S. Government Printing Office, October 1988), and *Helping America Compete: The Role of Federal Scientific and Technical Information*, OTA-CIT-454 (Washington, DC: U.S. Government Printing Office, July 1990). See also Jamie A. Grodsky, "The Freedom of Information Act in the Electronic Age: The Statute Is Not User Friendly," *Jurimetrics*, vol. 31, No. 1, fall 1990, pp. 17–51.

[29] See, for example, Henry H. Perritt, Jr., "Federal Electronic Information Policy," *Temple Law Review*, vol. 63, No. 2, 1990, pp. 202–250; and American Bar Association, Section of Administrative Law and Regulatory Practice, Report to the House of Delegates, "Public Access to Government Electronic Information Under the Freedom of Information Act," February 1990. Legislation to clarify the applicability of FOIA to electronic formats has been introduced in the prior two Congresses. See H.R. 2773, the Freedom of Information Public Improvements Act of 1989, June 28, 1989; H.R. 1423, the Freedom of Information Public Access Improvement Act of 1991, Mar. 13, 1991; and S. 1940, the Electronic Freedom of Information Improvement Act of 1991, Nov. 7, 1991.

[30] For background, see Susan G. Hadden and W. James Hadden, Jr., "Government Electronic Services and the Environment," contractor report prepared for the Office of Technology Assessment, November 1992.

The Government in the Sunshine and Federal Advisory Committee Acts are in some ways even more outdated than FOIA, because there is not yet a body of judicial and administrative interpretations that clearly establish their applicability to electronic formats and activities. The Sunshine Act requires, for example, that agencies provide adequate public notice of meetings and administrative or regulatory proceedings. The Advisory Committee Act requires that working papers, reports, and other documents be accessible to the public at or before the meeting for which they were prepared. Citizens could use electronic technology to remotely access agendas, schedules, and documents prepared in support of agency rulemaking proceedings or advisory committee meetings. Citizens could provide input electronically via computer conferences and networks, or participate in agency or advisory committee videoconferences.

Congress could revise these and related statutes to clarify the role of electronic technology, and the rights of citizens to use these technologies to participate in governance. Electronic technology also could help citizens provide feedback on what is perceived as right or wrong with government programs and services, including alleged fraud, waste, and abuse. Congressional and executive oversight bodies, including inspectors' general offices, could accept "whistleblower" input via computer bulletin boards and electronic mail, as well as 1-800 telephone numbers. Advocates believe that the "service" of helping the public know about and access government activities is really an obligation and, indeed, a requirement of democracy.

Electronic access could, on the other hand, raise new legal and constitutional issues about the limits of such citizen participation. The first amendment of the U.S. Constitution affirms the rights of citizens to free speech and to petition the government for redress of grievances. "Electronic" speech and petitioning, for example via computer bulletin boards, should be no different in principle than using mail, telephone calls, or face-to-face meetings. But some local governments and private vendors have been faced with difficult decisions about restricting the content of bulletin boards or computer conferences when electronic speech becomes abusive, obscene, or associated with criminal activity (e.g., drug sales or child pornography). Private vendors can and do enforce reasonable restrictions. Operators of taxpayer-supported bulletin boards, on the other hand, may be more reluctant to infringe on first amendment protections.

Only one of the many government bulletin boards reviewed by OTA has experienced significant problems—the City of Santa Monica, CA, "Public Electronic Network" (PEN). PEN is free to all residents via public terminals in libraries. Some of the computer conferences have included electronic discussion found to be offensive (although not illegal) by various participants and city officials. Inappropriate electronic behavior can be minimized, if not prevented, through education on electronic etiquette, adherence to reasonable rules of electronic exchange, and sanctions for flagrant abuse (e.g., revocation of passwords and limitations on use).

ACCESS TO CONGRESSIONAL INFORMATION

Congress could look for further opportunities to use information technology to improve citizen access to congressional activities. Fairly extensive pilot testing suggests, for example, that videoconferencing can be cost effective for congressional hearings when witnesses have access to videoconferencing facilities and would otherwise have to travel to Washington, DC, either at their own or congressional expense.[31] The House of Representatives' leadership has established a task force to move videoconferencing from experimental to operational status; several House committee rooms now are wired for videoconferencing.[32] Videoconferencing also has proven useful for electronic town meetings between Members of Congress in Washington, DC, and citizens back home.

Electronic dissemination of legislative information also has been studied and debated for several years.[33] Local governments have demonstrated that schedules and agendas of city council meetings, and related staff reports, can be provided via simple, low-cost dial-up computer bulletin boards.[34] Several private commercial companies and not-for-profit organizations already disseminate some congressional information via on-line services, computer networks, and compact optical disks. Participants in OTA-sponsored computer conferences expressed considerable interest in electronic access to Congress.[35]

Congress could set up a family of computer bulletin boards that would provide schedules for committee hearings and floor debates, bill status, and witness lists. These could be accessible via both dial-up and networked computers using a wide range of public and private systems. House and Senate computer systems also could be used by interested Members and staff to participate in computer conferences with citizens around the Nation, and to exchange comments on current issues with constituents and others via dial-up remote computer access. Several congressional offices are experimenting with computer networking and bulletin boards.

Videoconferencing and computer bulletin boards for Congress should be technically straightforward and relatively inexpensive to implement. But several specific questions would need attention, including:

1. staffing and training needs;
2. procedures and responsibilities for scheduling videoconferences, and creating and updating the databases;
3. cost sharing and cost recovery;
4. rules to assure open, equitable access; and
5. public/private sector roles and partnerships (including the involvement of the Senate Computer Center, House Information Systems Office, Government Printing Office, and various commercial telecommunication, value-added, and information service providers).[36]

Electronic connections to the public will require changes in the ways individual members of Congress and their staffs, and Congress as an institution, manage and respond to constituent information. This might not require more resources and staff, however. It might even cut costs, given the very large amount of staff time and money already spent on handling constituent mail, telephone calls, and meetings.

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[31] See Stephen Frantzich, "Electronic Service Delivery and Congress," contractor report prepared for the Office of Technology Assessment, January 1993. Also see Fred B. Wood, Vary T. Coates, Robert L. Chartrand, and Richard F. Ericson, "Videoconferencing Via Satellite: Opening Congress to the People," The George Washington University Program of Policy Studies in Science and Technology, April 1979.

[32] Including the House Committees on Agriculture; Armed Services; Energy and Commerce; Education and Labor; Foreign Affairs; and Science, Space, and Technology.

[33] See Frantzich, op. cit., footnote 31; OTA, *Informing the Nation*, op. cit., footnote 28.

[34] See, for example, the Pasadena, CA, "Public Access Library System," and the Oakland, CA, "Community Access Project," discussed in OTA, "California Trip Report," Nov. 10, 1992.

[35] See Frank Odasz, Big Sky Telegraph, "Computer Conference on Electronic Delivery to Rural/Small Town America," contractor report prepared for the Office of Technology Assessment, Jan. 8, 1993; T.M. Grundner, National Public Telecomputing Network, "The OTA/NPTN Teleforum Project: An Experiment With a Multi-City Electronic Town Hall," contractor report prepared for the Office of Technology Assessment, January 1993.

[36] See relevant discussion in later sections of the chapter on "Pricing and Public Access" and "Contracting Out/Procurement", also see Frantzich, op. cit., footnote 31; OTA, *Informing the Nation*, op. cit., footnote 28; and OTA, *Helping America Compete*, op. cit., footnote 28.

Congress, or the Senate and House individually, could establish a legislative branch task force on congressional computer bulletin boards or, more broadly, on congressional electronic service delivery. Given their jurisdiction over congressional computer and telecommunications systems, the Senate Committee on Rules and Administration and House Committee on House Administration could hold hearings, separately or jointly with the Senate Committee on Governmental Affairs and House Committee on Government Operations. These topics might also be addressed by the Joint Committee on the Operations of Congress.

Congress gradually is building the information infrastructure on Capitol Hill that would support electronic service delivery.[37] Ultimately, in addition to scheduling and status information, congressional reports and documents also could be made available electronically. These could include committee reports and hearings, as well as public documents issued by the congressional support agencies—the Congressional Research Service (CRS), Congressional Budget Office (CBO), General Accounting Office (GAO), and Government Printing Office (GPO),[38] in addition to the Office of Technology Assessment (OTA). Several of these congressional agencies (e.g., GPO, GAO, OTA) already are experimenting with electronic dissemination. GPO now has a statutory mandate to provide on-line public access to the *Congressional Record*;[39] this could logically extend to other congressional documents. Taken together, electronic service delivery applications could further open Congress to the people, help Congress better manage its own information, strengthen the role of Congress as the "people's branch of government," and, in the process, set an example for the executive branch and the Nation.

ARCHIVING ELECTRONIC RECORDS

Another important aspect of access is the ability of the public to retrieve historical records and information developed by or for the government. Access to decisionmaking documents is especially important. These materials typically offer one of the few avenues for researchers, historians, and concerned citizens to more fully understand the "whys" and "hows" of Federal actions. The Federal Records Act and related statutes set out requirements for archiving agency documents. Once again, however, these statutes predate the modern electronic era. The Act was amended in 1976 to cover "machine-readable materials," but has not been updated to address the complex challenges and opportunities presented by personal computers, electronic mail, compact optical disks, and computer networking.[40]

The National Archives and Records Administration (NARA) oversees agency archiving and the operation of various Federal archival centers and activities. NARA is aware of the opportunities and problems presented by electronic technology, and has taken some noteworthy initiatives—establishing a Center for Electronic Records, sponsoring interagency conferences and agreements, and developing manuals and other guidance for agencies on how to archive electronic materials. NARA is working with selected mission agencies in developing procedures for appropriate archiving via optical disk, electronic mail, and computer networking—including Internet. NARA provides guidance to agencies on both (a) retaining electronic materials so that they are accessible, readable, etc., whenever the agency needs them (in months or years); and (b) preserving electronic records for future generations under NARA's legal and physical custody.

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[37] Congress is installing a local area fiber optic network that will serve the House, Senate, and congressional support agencies, with gateways to private-sector computer and telecommunication networks.

[38] See the Government Printing Office Electronic Information Access Enhancement Act of 1993, Public Law 103-40.

[39] Ibid.

[40] The term "machine readable materials" was added by the Federal Records Management Amendments of 1976, Sec. 4 (Oct. 21, 1976, 90 Stat. 2723-2727). 44 USC 33 now defines "records" to include "all books, papers, maps, photographs, machine readable materials, or other documentary materials, regardless of physical form or characteristics, made or received by an agency of the U.S. Government under Federal law or in connection with the transaction of public business and preserved or appropriate for preservation by that agency or its legitimate successor as evidence of the organization, functions, policies, decisions, procedures, operations, or other activities of the Government or because of the informational value of data in them."

Some scholars and historians believe that NARA's efforts are still too little, too late. They feel that the Federal Government is in danger of losing its history because it is failing to capture the rapidly increasing portion of Federal records and decision documents that are created, stored, and sometimes destroyed electronically.[41] Scientists share a related concern that large volumes of scientific data, for example from earth-observing satellites, are stored on obsolete and deteriorating electronic media (i.e., magnetic tapes).[42] Fortunately, newer technologies like optical disks provide viable options for long-term archiving of Federal records and data. NARA has been cautious in its adoption of new technologies due, in part, to concern over rapid technical change and lack of hardware and software standards needed to assure future access. Archival technologies should conform to international technical standards to assure long-term accessibility.

Congress could review and update the Federal Records Act and the role of NARA to ensure that modern information technology is applied and that archiving needs and records management are explicitly addressed in the development of electronic delivery systems.[43] Current NARA guidance calls for an integrated approach.[44] But agency compliance is spotty at best; stronger enforcement appears necessary. NARA cannot be expected to do this alone; cooperation from OMB and the General Services Administration (GSA), among others, is essential.[45] It would help if Congress included NARA in any review of executive branch agencies responsible for governmentwide management, policy, and oversight of electronic service delivery—broadly defined.

DIRECTORIES OF ELECTRONIC SERVICES

If citizens are going to use and benefit from electronic service delivery, they need to first know what services are available and where. OTA research reaffirms the need for directories or, in this case, "electronic road maps" to help citizens identify and locate relevant services. Congress has long recognized this need in mandating a variety of directory services, ranging from the catalog of domestic assistance programs and a Federal information center (run by GSA), to a catalog of Federal research in progress and bibliographic index of technical reports (maintained by the National Technical Information Service (NTIS)), to the catalog of government publications (prepared by GPO). Numerous agencies operate clearinghouses and 1-800 telephone numbers that help direct citizens to a wide variety of services—from grant and loan programs; to education and training; to dissemination of reports and databases.

The mission agencies are adapting to electronic technology by setting up computer bulletin boards, placing directory information on both computer networks and compact optical disks, and participating in interagency efforts to develop

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[41] See, for example, National Academy of Public Administration, *The Effects of Electronic Recordkeeping on the Historical Record of the U.S. Government* (Washington, DC: National Archives and Records Administration, January 1989). NARA gave increased attention to electronic recordkeeping in the 1990s, and has further intensified its electronic initiatives during 1993—but still lags the technology pace being set by many mission agencies and private companies.

[42] See OTA, *Helping America Compete*, op. cit., footnote 28.

[43] For general discussion, see, for example, Henry H. Perritt, Jr., "Electronic Records Management and Archives," *University of Pittsburgh Law Review*, vol. 53, 1992, pp. 963–1024; Administrative Conference of the United States, Recommendation 90-5, "Federal Agency Electronic Records Management and Archives," *Federal Register*, vol. 55, No. 250, Dec. 28, 1990, pp. 53270–53271.

[44] See, for examples, NARA regulations in 36 *CFR* 1234.10(d) "[the agency head shall establish] procedures for addressing records management requirements...before approving new electronic records systems or enhancements to existing systems"; and 36 *CFR* 1234.22(a) "Electronic records systems that maintain the official file copy of text documents on electronic media shall...provide for the disposition of documents including, when necessary, the requirements for transferring permanent records to NARA."

[45] OMB could check agency compliance when reviewing agency 5-year IRM plans; GSA could do likewise when reviewing agency requests for delegation of procurement authority.

PHOTOS: FRED B. WOOD

Top: *One of several dozen microcomputers available to students at the Little Big Horn College.*

Bottom: *Little Big Horn College, Crow Indian Reservation, Montana.*

governmentwide directories (e.g., regarding global climate change data or geographic information systems). Many agencies are creating and operating electronic directories entirely inhouse (although frequently with at least some private sector contracting support), while others form partnerships with private sector commercial or not-for-profit organizations. In some cases, private firms develop and market electronic directories on their own initiative if sufficient demand exists.

The complexity of agency activities, combined with the changed economics of information technology, clearly favors decentralized approaches to electronic directories. But this, in turn, increases the need for common standards to ensure both technical interoperability and consistent formatting among directories. Otherwise chaos would result. The trend toward decentralized directories also complicates the roles of agencies responsible for governmentwide directories that have operated primarily in a centralized mode. For several years, Congress, OMB, agencies, and interested parties have debated the need and options for a governmentwide directory, with considerable disagreement on how to proceed, what technologies to use, and who should be in charge (e.g., OMB, GPO, NTIS, or GSA).[46] This has occurred despite the fact that the Paperwork Reduction Act of 1980 mandated the implementation of a governmentwide Federal Information Locator System (FILS), and that the Paperwork Reduction Reauthorization Amendments of 1986 reaffirmed congressional desire that FILS be fully implemented.[47]

OTA's current and prior research[48] has reaffirmed the need for a publicly accessible locator to Federal services (including information). OTA has concluded that an effective solution would include the following elements:

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[46] See Charles R. McClure, Ann Bishop, Philip Doty, and Pierrette Bergeron, *Federal Information Inventory-Locator Systems: From Burden to Benefit* (Syracuse, NY: Syracuse University School of Information Studies, 1990).

[47] As implemented by OMB during the 1980s, FILS primarily was used to check on agency information collection activities, not to facilitate public access to agency information. For an historical overview, see Gary D. Bass and David Plocher, "Finding Government Information: The Federal Information Locator System (FILS)," *Government Information Quarterly*, vol. 8, No. 1, 1991, pp. 11-32.

[48] See OTA, *Helping America Compete*, op. cit., footnote 28, and *Informing the Nation*, op. cit., footnote 28. Also see Fred B. Wood, "Title 44 and Federal Information Dissemination—A Technology and Policy Challenge for Congress: A Viewpoint," *Government Publications Review*, vol. 17, 1990, pp. 1-5.

1. an interagency task force would develop standards for agency-specific and governmentwide directories to Federal services;[49]
2. the task force could be coordinated by NIST or GSA, or perhaps by an existing interagency committee,[50] but would need high-level support from the White House, including OMB and the Office of Science and Technology Policy (OSTP);
3. the task force would need active participation from agency innovators;
4. the task force would recommend consistent formats and compatible software for agency directories;
5. directories would be accessible on a dial-up and networked basis (including wide-area and Internet[51]) and could be downloaded for use in off-line electronic formats, such as compact optical disks, multimedia kiosks, and the like;
6. every Federal executive agency would develop and maintain an electronic directory to its own services (including information services);
7. individual agencies would have discretion in implementing their own directories, so long as the directories meet governmentwide standards;
8. GPO and NTIS would continue to index and catalog government reports and documents, with NTIS concentrating on material of a more technical nature;
9. GPO and NTIS would offer gateway and wide-area directory services[52] (i.e., a "virtual" directory), as well as off-line electronic formats—individual agencies and the private sector could do the same; and
10. agency electronic directories would be accessible via commercial and not-for-profit networks and gateways, and could be downloaded for use in commercial and not-for-profit off-line electronic products.

This approach appears consistent with—but goes beyond—the recently revised OMB Circular A-130 and the recently enacted "GPO Electronic Information Access Improvement Act."[53] To implement this scenario, legislative and/or executive action would be needed to: 1) assign primary responsibility for directory development to an interagency task force; 2) direct the development of a two-tier directory system—governmentwide

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[49] The Interagency Committee on Data Management for Global Change and the interagency CENDI committee (Commerce, Energy, NASA, Defense Information) have been working on directory standards for several years.

[50] Such as a computer networking committee of the Federal Coordinating Committee on Science, Engineering, and Technology; or CENDI, an interagency coordinating committee on scientific and technical information.

[51] To include use of Wide Area Information Server (WAIS) and Gopher software that permits easy electronic access to information and databases at dispersed geographic locations.

[52] See Charles R. McClure, William E. Moen, and Joe Ryan, "Design for an Internet-Based Government-Wide Information Locator System," *Electronic Networking*, vol. 2, No. 4, winter 1992, pp. 6–37; U.S. Government Printing Office, *GPO/2001: Vision for a New Millennium* (Washington, DC: U.S. Government Printing Office, 1992); National Technical Information Service, U.S. Department of Commerce, *NTIS Business Plan* (Washington, DC: NTIS, July 1992). Also see the Government Printing Office Electronic Information Access Improvement Act of 1993, Public Law 103-40, that mandates GPO to, among other things, develop an electronic directory to Federal on-line information; and the American Technology Preeminence Act of 1991, Public Law 102-245, that mandates NTIS to study the feasibility of an on-line electronic directory. These Acts clarify the authority of GPO and NTIS to disseminate information in electronic formats. Public Law 102-245 also requires Federal agencies to submit to NTIA in a timely manner all unclassified scientific, technical, and engineering information that results from federally funded research and development. Earlier NTIS and GPO electronic initiatives were delayed in part by debates over privatization of NTIS and the appropriate role of GPO in electronic information dissemination. See OTA, *Informing the Nation*, op. cit., footnote 28; OTA, *Helping America Compete*, op. cit., footnote 28; Wood, "Title 44 and Federal Information Dissemination," op. cit., footnote 48; Fred B. Wood, "Proposals for Privatization of the National Technical Information Service: A Viewpoint," *Government Publications Review*, vol. 15, 1988, pp. 403–409; and Fred B. Wood, "Office of Technology Assessment Perspectives on Current U.S. Federal Information Issues," *Government Publications Review*, vol. 17, 1990, pp. 281–300.

[53] Public Law 103-40. Also see Information Infrastructure Task Force, op. cit., footnote 4.

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Microwave and satellite dishes at the University of Alaska at Anchorage.

“gateway” or “virtual” directories, and agency-specific directories; 3) reaffirm that the governmentwide and agency directories will be broadly available in on-line and off-line electronic formats, and that governmentwide directories will complement and not supplant or preempt line agency initiatives; 4) ask the task force to set up a technical support group to develop the necessary directory standards; 5) include representatives of the Depository Library Program, Consumer Information Center, Federal Information Centers, agency clearinghouses, community information and referral centers, and NARA, among others, in the task force work; and 6) establish a framework for oversight and accountability, including at least general milestones for implementation. To assure success, the task force needs to approach this assignment with creativity and flexibility, include users in planning and implementation (see chs. 5 and 6), and build on the rapidly advancing state-of-the-art in directory technology.[54]

PRICING AND PUBLIC ACCESS

The shift to electronic service delivery raises a fundamental issue about the pricing of such services. Some Federal, State, and local government agencies view electronic delivery as an opportunity to recover costs or actually generate net revenues. This would be accomplished by charging users for, in effect, the privilege or convenience of receiving services electronically rather than having to telephone, write, or show up in person at an agency office. The California kiosk system, for example, might charge users extra to renew drivers' licenses at remote locations, presumably since users are saving time (and money) by not having to wait in line at a State office. State and local government use of 1-900 telephone numbers is increasing rapidly as a means to recover costs and pay for system development in financially strapped jurisdictions.[55] Some local governments charge users enough for local land-use information to cover not only the cost of providing information, but the cost of developing the automated system as well.[56] While real estate companies and developers may be able to afford these charges, local citizen and consumer groups on tight budgets may be placed at a disadvantage.

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[54] This includes, for example, WinWAIS (WAIS using Windows software) available as freeware from the National Clearinghouse for Network Information Discovery and Retrieval; InterNIC (Internet Information Center) for new user orientation and directory services, among others [some individual agencies are establishing their own NICs, e.g., AgriNIC]; and emerging standards for information search and retrieval using low-cost or free software (for more on the Z39.50 standard, contact the U.S. Geological Survey).

[55] 900 charges can approach private sector commercial levels. The Los Angeles County Planning Department, for example, charges 75 cents per minute ($45/hour) for remote computer access to planning commission directives, zoning information, and development proposals. See Brian Miller, “900 Numbers Speed Service,” *Government Technology*, January 1993, pp. 8–9.

[56] See Public Technology, Inc., and the Videotex Industry Association, *Local Government Opportunities in Videotex: A Guide to Communicating and Gaining Review Through Electronic Services* (Washington, DC: Public Technology, Inc., 1991); and Patricia T. Fletcher, Stuart I. Bretschneider, and Donald A. Marchand, *Managing Information Technology: Transforming County Governments in the 1990s* (Syracuse, NY: Syracuse University School of Information Studies, August 1992).

Charging for electronic delivery creates a potential barrier to access and could create new or aggravate existing inequities. Public policy could be based in part on whether electronic delivery is viewed as a luxury or frill or specialized application, or, on the other hand, as a likely major mode of delivery for a growing range of government services. To the extent the Federal Government is shifting to electronic delivery, as appears to be the case, then Congress and the President need to pay careful attention that this shift improves—not impairs—equity of access. Pilot projects suggest that electronic delivery can benefit the economically and educationally disadvantaged, but if the price is too high (or the training inadequate or equipment unavailable) these benefits will not be realized. Also, many Federal programs strive to reach as many eligible citizens as possible, presumably because of the substantial benefit not only to the recipients, but to society-at-large (e.g., from health, nutrition, training, and education services). From this perspective, it makes little sense to erect price (or other) barriers to electronic delivery for the very persons the programs are intended to benefit.

But electronic delivery does cost money, and various forms of cost- sharing may be reasonable for specific programs and recipients. At present, for example, most users of Federal agency electronic bulletin boards must pay long-distance telecommunication charges themselves, but agencies frequently assess minimal access charges or none at all. This controls the Federal cost and may tend to minimize frivolous use, but it also may discourage legitimate use for those who cannot afford long-distance charges or do not have (or cannot afford) a telephone and computer. The exact cost structure and pricing formula may need to be determined on a case-by-case basis, within an overall framework established by Congress.

To set policy, Congress could use a modified version of the pricing framework developed for Federal information dissemination. As debated over the last several years and embodied in the recently revised OMB Circular A-130, Federal agency pricing may not exceed the marginal cost of dissemination and may be reduced or waived entirely at the discretion of the agency head.[57] The exact definition of "marginal cost" is still somewhat ambiguous, as is a determination of whether "free" really means zero cost to the user (who may still have to pay for equipment and telecommunications). Congress could direct agency heads, when setting prices, to give priority to assuring equity of access and fulfillment of statutory agency and program goals and that, in any event, the prices should not exceed the marginal cost of electronic service delivery.[58] Congress could specify that pricing should not be used to recover the cost of system design and development, or of the services being delivered, only—at most—the cost of delivery. This presumes, however, that Federal agencies are adequately funded for technology innovation and system development for electronic delivery.

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[57] See Office of Management and Budget, Circular A-130, "Management of Federal Information Resources," Dec. 24, 1985, 50 *Federal Register* 52730–52751; OMB, proposed revision of Circular A-130, 83 *Federal Register* 18296–18306; and final revision, op. cit., footnote 1. Congress may need to clarify that OMB Circular A-25 on "User Charges" does not authorize or require full cost recovery for Federal services intended to benefit the general public. To the contrary, OMB Circular A-130 takes precedence. See Office of Management and Budget, OMB Circular A-25 Revised, "User Charges," *Federal Register*, vol. 58, No. 134, July 15, 1993, pp. 38142–38146. Also see OTA, *Informing the Nation*, op. cit., footnote 28; OTA, *Helping America Compete*, op. cit., footnote 28; Interagency Working Group on Government Electronic Information, "Public Access to Government Electronic Information: A Policy Framework," Aug. 10, 1992, working draft; and U.S. Congress, House, Committee on Government Operations, Subcommittee on Government Information, Justice, and Agriculture, *Creative Ways of Using and Disseminating Federal Information, Hearings*, June 19, 1991, and June 4, 1992. The marginal cost-pricing principle also is reflected in proposed legislation, such as H.R. 629, the Improvement of Information Access Act of 1993, Jan. 26, 1993, and S. 681, the Paperwork Reduction Reauthorization Act of 1993, Mar. 31, 1993.

[58] See OTA, *Helping America Compete*, op. cit., footnote 28. Federal agency pricing of information in electronic formats varies widely; the principle of marginal cost pricing appears to be inconsistently or erroneously applied. A 1993 GAO survey, for example, found that agency pricing of CD-ROMs varies from a few dollars per disk to over $1,000 per disk. See U.S. General Accounting Office, *Federal CD-ROM Titles: What Are Available and How They Are Priced*, GAO/IMTEC-93-3-34FS (Washington, DC: U.S. General Accounting Office, 1993).

Congress may need to review policies for those agencies that do not receive adequate funding for system development, such as NTIS. NTIS faces a dilemma—with no appropriated funds, it must charge more than marginal cost (narrowly defined) for some products and services in order to cover the costs of basic archiving activities and product and system development. Congress also might consider authorizing agencies to retain funds received from sale of products and services—so long as pricing and other policies are complied with. At present, agencies must return such funds to the U.S. Treasury, unless specifically exempted. Agency use of retained funds could be restricted to electronic delivery innovations or other specified purposes, such as subsidies to disadvantaged users.

Effective electronic delivery to economically or educationally disadvantaged users may require not only "free" delivery, but at least partial Federal subsidization of the requisite equipment and training. Federal agencies might offer, for example, to pay part of the cost of kiosk deployment or 1-800 telephone numbers for computer access in distressed areas as part of an intergovernmental partnership or public/private partnership—possibly with telephone, cable, computer networking, or value-added information companies. Or Federal agencies might provide electronic delivery infrastructure grants or vouchers to schools, libraries, and small businesses in disadvantaged areas; these should, of course, be closely coordinated with any agency information technology funds set aside for grassroots involvement, community communication centers, or local innovation.[59]

As part of an electronic service delivery "safety net," Congress also could initiate a review of the roles the Consumer Information Center (CIC) and Depository Library Program (DLP) might play in assuring equity of access. The CIC is operated for GSA by GPO's Superintendent of Documents (SupDocs), and provides copies of free or low priced agency pamphlets and publications to the general public. CIC's potential role in electronic delivery has received little attention to date. The DLP also is operated by SupDocs, and provides copies of selected agency reports to roughly 1,400 designated libraries throughout the United States, at least one in every State and congressional district. The cost of documents provided to depository libraries is covered by agency budgets and/or the DLP direct appropriation, but each library must pay the costs of storing, equipping, and staffing the government documents collection. The DLP serves all citizens, free of charge.

The DLP's role in electronic delivery has been studied and debated for several years. The recently revised OMB Circular A-130 requires Federal agencies to submit all required materials to the DLP, regardless of format, to the maximum extent feasible. Recently enacted legislation[60] clarifies and strengthens GPO's general role in electronic delivery and information dissemination, which also should benefit the DLP. While some DLP policy and funding issues remain, the significant potential role for depository libraries (and libraries in general) in electronic delivery is now well established.[61]

Congress could, as part of any governmentwide electronic delivery initiative, mandate a careful review of all Federal or federally supported programs intended to help assure an access "safety net" for citizens who do not have adequate financial, institutional, or technical resources. The review could include not only CIC and DLP, but also the Federal Information Center program run by GSA, the network of U.S. Department of Agriculture (USDA) Extension Service offices, the numerous individual agency clearinghouses and libraries (those run directly by agency personnel and by agency contractors), and various agency, interagency, NTIS, and GPO electronic directory initiatives—all of which could have some role in an electronic service delivery "safety net."

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[59] See chs. 5 and 6.

[60] See Public Law 103-40, op. cit. footnote 52.

[61] See John Harris, Alan F. Westin, and Anne L. Finger, Reference Point Foundation, "Innovations for Federal Service: A Study of Innovative Technologies for Federal Government Services to Older Americans and Consumers," contractor report prepared for the Office of Technology Assessment, February 1993; OTA, *Helping America Compete*, op. cit., footnote 28; OTA, *Informing the Nation*, op. cit., footnote 28. Also see OMB, Circular A-130, op. cit., footnote 1.

CONTRACTING OUT/PROCUREMENT

As with other Federal activities, some electronically delivered services will be contracted out to the private sector, others will be implemented by the agencies themselves, and still others will proceed in partnerships among Federal agencies, their State/local counterparts, and/or the private sector. Privatizing government activities is a popular although controversial notion. At one extreme, privatization advocates look for opportunities to get the government out of the "business" of providing materials or services that could, in principle, be supplied by the private marketplace. Opponents argue, with some justification, that Congress established many Federal programs to meet important public policy goals that probably would not be met without government involvement and funding. When carefully considered, most privatization proposals to date have focused on contracting out or eliminating current government services. The "reinventing government" theme is drawing more attention to the role of contracting in systems integration and outsourcing of electronic delivery, but it also is spotlighting the growing concern about possible conflicts of interest and over-reliance on contracting.

The OMB Director has initiated a review of current Federal contracting policies and practices, including OMB Circular A-76 on "Performance of Commercial Activities," with particular attention to accountability, cost effectiveness, and the inherent nature of governmental functions. Congress could evaluate the results of the administration's review, when complete, to determine if the proposed policies better balance the competing principles relevant to electronic delivery, such as:

- Public Responsibility—However implemented, the government in most cases must remain responsible for assuring that electronic delivery meets the goals set by Congress for each service and for electronic delivery generally.
- Equity of Access—An important policy goal is that electronic delivery improve public access to Federal services and broaden public awareness of such services, and that it reduce—not increase—the chasm between socioeconomic "haves" and "have-nots."
- Government Accountability—Some Federal services must be implemented by the government to assure accountability and integrity of the process, provide independent management and oversight, and preclude conflicts of interest.
- Government Efficiency—The public clamor to cut government expenditures and get more "bang" for the tax "buck" does not automatically translate into increased contracting. Contracting out can end up costing the government more money, and, if carried too far, can deny the government the expertise needed to effectively monitor contractors. The most efficient way for agencies to implement electronic delivery usually is outsourcing to commercial providers of computer and telecommunications equipment and networks. But the operation of the delivery system—at least the agency part of the system—may sometimes be done more efficiently by the agency. The determination of the best mode of service delivery must be made on a case-by-case basis.
- Government Competition—Contracting out also minimizes competition between the government and private sector, and can stimulate the private marketplace. At the Federal level, computer and telecommunications equipment is competitively procured. Federal civilian agencies likewise use commercial computer and telecommunication networks almost exclusively, rather than building their own. Agencies typically contract with commercial systems

integrators for the design, implementation, and sometimes operation of the major automated agency systems. Electronic service delivery might raise concerns about government competition with the private sector, to the extent that electronic delivery is similar to operating agency computer centers, clearinghouses, libraries, or information dissemination programs. Privatization of such activities has proven controversial. Some agencies contract out; others do not. The cost effectiveness of contracting these activities is difficult to verify. Agencies rarely conduct follow-up evaluations.

To set a contracting-out policy, the Federal Government could use a modified version of the public-private framework developed for Federal information dissemination.[62] The policy could direct agencies, when planning and implementing electronic delivery, to assure—as first priority—that public accountability, equity of access, and other statutory public policy goals are met. Within that context, the policy could require agencies to: 1) deploy electronic delivery in ways that are cost effective; 2) use commercial off-the-shelf equipment and networks to the extent possible; 3) carefully and creatively consider contracting or partnering roles for the private sector; and 4) assure, whenever the private sector is involved, a level competitive playing field and open access to both the delivery vehicles and the services themselves (to the extent provided or limited by law).

Open access has been a controversial issue with respect to Federal information services. Federal information cannot be copyrighted,[63] but some agencies have used licensing agreements for various purposes, such as: 1) generating revenue to cover the cost of dissemination; 2) limiting or controlling the resale or enhancement of Federal information by private companies; and /or 3) helping assure the quality of the information by enforcing restrictions on allowable reuse or redissemination of the information. Also, Federal technology transfer laws could erode the copyright prohibition if extended to allow agencies to enter into licensing agreements with private companies that restrict access to technical data and software developed by Federal employees.[64]

Consumer, library, and public advocacy groups are concerned about any restrictions on access. Agency proposals to permit copyrighting of federally funded bibliographic and other databases have proven inflammatory. The information industry asks that licensing agreements, when used, be available to any qualified and interested company and that the licensing fee not exceed the marginal cost of providing the information—in order to ensure a level competitive playing field. The practice or plans of some State and local governments to either go into business for themselves or contract with selected private companies to sell public information or other services at a "profit" would raise serious concerns at the Federal level (profit defined as charging more than the marginal cost or, possibly, whatever the market will bear).[65]

Electronic service delivery should, overall, be a net positive sum activity for both the Federal Government and the private sector. A carefully crafted policy should simultaneously enhance equity of access to Federal services; improve the productivity and efficiency of Federal service delivery; and stimulate the private sector through direct procurements of off-the-shelf items, contracting out for technology systems and services, and creation of new value-added competitive marketplace opportunities.

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[62] See OMB, proposed and final revisions to Circular A-130, op. cit., footnote 57; OTA, *Helping America Compete*, op. cit., footnote 28.

[63] For private information, which can be copyrighted, the intellectual property issues surrounding electronic formats are complex and controversial. For a discussion, see U.S. Congress, Office of Technology Assessment, *Finding A Balance: Computer Software, Intellectual Property, and the Challenge of Technological Change*, OTA-TCT-527 (Washingon, DC: U.S. Government Printing Office, May 1992).

[64] See OTA, *Helping America Compete*, op. cit., footnote 28.

[65] A case in point is the Federal Maritime Commission's Automated Tariff Filing and Information System (ATFI). After considerable debate, Congress directed the FMC to collect fees for direct and indirect use of AFTI, in an attempt to generate revenues that would offset phasing down or out the unpopular boat tax. FMC responded with proposed rules that attempt to very tightly control all use of AFTI data, charge AFTI access fees that appear to be higher than marginal cost, and assert that AFTI data are the exclusive property of the FMC. The FMC proposals are strongly opposed by representatives of the information industry, libraries, and public interest and consumer advocates, and conflict with several policy principles in the recently revised and reissued OMB Circular A-130; see OMB, op. cit., footnote 1. Public advocacy groups have raised similar concerns about the Security and Exchange Commission's Electronic Data Gathering and Retrieval System (EDGAR) and the Department of Justice's legal information system (known as JURIS). In both the EDGAR and JURIS cases, the contracting out of information services has led to the imposition of limitations on use and/or high user fees that have had the effect of restricting public access.

Absent improvements in procurement practices, major contracting for electronic service delivery could further strain an already overly complicated, lengthy, rigid, and—some would argue—unnecessarily expensive Federal procurement process. Federal technology managers frequently find themselves locked in by cumbersome procurement practices that leave little room to adapt to technology changes and result in guaranteed early obsolescence of Federal automation programs. Major agency automation initiatives have, in the past, typically taken several years to a decade or more to complete. Procurement strategies that may have worked reasonably well in the 1970s and 1980s are likely to result in automated systems for the 1990s that will be two or three generations of technology behind on the day they become operational. Computer and telecommunication companies generally prefer that the government define its requirements in functional terms rather than attempting to specify detailed technical designs. This provides greater flexibility to the private sector in creatively responding with proposed technological solutions.

OTA concluded that Federal agencies need to: 1) take advantage of new breakthroughs in less expensive off-the-shelf commercial equipment, software, and services, and the accelerating trend toward interoperable and compatible technologies; 2) find new ways to integrate pilot and demonstration projects, requests for information (RFIs), and requests for proposals (RFPs) that will increase the flexibility and cut the time and cost of Federal information technology procurements; 3) seek creative opportunities for intra- and interagency procurement partnerships that take advantage of the economies of scale and scope made possible through electronic delivery; 4) mandate improvements in the system plans and designs on which the procurements ultimately are based, using evolutionary rather than static procurement strategies; and 5) use information technology to open up competition and cut procurement overhead and red tape.[66]

OTA's vision of Federal procurement practices takes full advantage of information technology to:[67]

1. cut the response time for contracting by using electronic bulletin boards and computer networking to announce contract solicitations, and to receive questions and comments; and electronic data interchange (EDI)—with electronic signatures—to receive bids and proposals;
2. cut the cost and paperwork by encouraging all-electronic contracting and electronic filing of contract documents (filing of private sector responses to contract solicitations and agency filing of contract records); and
3. reduce the complexity of contracting through fewer, simpler, streamlined procurement regulations available in a variety of electronic formats.

Congress could direct OMB and GSA to review and revise procurement procedures accordingly. Congress could hold periodic oversight hearings on information technology procurement, and, if

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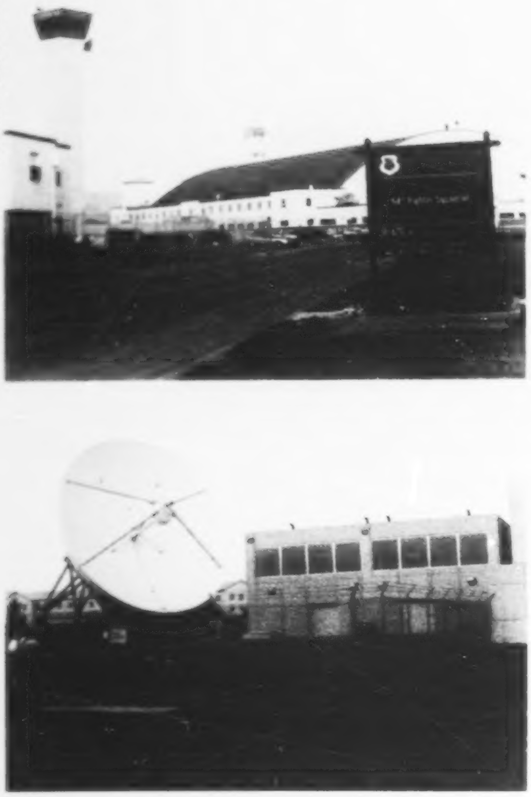
[66] Based on the results of OTA's own research and on reviews by the Department of Defense and various nongovernmental groups. See, for example, Thomas Giammo, *Managed Evolutionary Development GUIDEBOOK: Process Description and Application* (Arlington, VA: U.S. Patent and Trademark Office, February 1993); Steven Kelman, Jerry Mechling, and John Springett, *Information Technology and Government Procurement: Strategic Issues for the Information Age* (Cambridge, MA: John F. Kennedy School of Government, Harvard University, June 1992); Armed Forces Communications and Electronics Association, "Evolutionary Acquisition Draft Report," Mar. 12, 1993.

[67] The General Services Administration makes some price schedule information available via bulletin board; the Defense Commercial Communications Office places full requests-for-proposals on a bulletin board.



PHOTOS: FRED B. WOOD

Top: *The 54th Fighter Squadron at Elmendorf Air Force Base, Alaska, depends on telecommunications and computer systems for air traffic control and military intelligence.*

Bottom: *One of several satellite earth stations at Elmendorf Air Force Base, Alaska.*

necessary, consider statutory changes and accompanying report language to provide further, stronger guidance (possibly including revisions to the Brooks Act,[68] Competition in Contracting Act,[69] Paperwork Reduction Act,[70] and other Federal procurement statutes).

The transition to electronic procurement, however, raises equity of access issues for smaller businesses and not-for-profit organizations that may not have the expertise, equipment, or resources needed for participation. In this sense, the small-business community faces challenges similar to many government service recipients. Equitable competitive opportunities for small businesses can be furthered by including them in broader grassroots and partnering initiatives designed to help assure equity of access to electronic delivery (see chs. 5 and 6).[71]

TECHNICAL STANDARDS

Electronic service delivery will intensify the need for interoperability among Federal agency computer systems, and compatibility of Federal systems with the commercial telecommunications and computer infrastructure. The economies of scale and scope offered by electronic delivery will be largely lost if Federal agencies (and, where appropriate, their State/local counterparts) cannot use the same kinds of networks and "platforms" (e.g., personal computers, kiosks, ATMs) for getting services to the people.

Common technical standards thus are an essential component of cost-effective electronic delivery. The Federal Government should, to the maximum extent possible, use equipment and systems that incorporate widely accepted private sector technical standards, where they exist. Federal procurements of electronic delivery technologies and systems could mandate use of appropriate standards. The computer and telecommunication industries have, in recent years, increasingly recognized that common standards are in their own, as well as the government's, interests. Many computer and telecommunication products and services are on the threshold of becoming mass consumption items, and common technical standards can help further develop the market (e.g., as with CD-ROM or electronic mail standards). Where private sector standards do not yet exist, the Federal Government could exert its influence through the existing public-private standards-setting processes.[72]

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[68] Brooks Act of 1965, Public Law 89-306.

[69] Competition in Contracting Act of 1984, Public Law 98-369.

[70] Paperwork Reduction Act of 1980, Public Law 96-511, and Paperwork Reduction Reauthorization Act of 1986, Public Law 99-500.

[71] For further discussion of business use of information technology for marketing and contracting, see U.S. Congress, Office of Technology Assessment, *The Electronic Enterprise: Opportunities for American Business and Industry*, in progress. H.R. 2238, the Federal Acquisition Improvement Act of 1993, introduced May 24, 1993, and reported out by the House Committee on Government Operations on July 28, 1993, would, among other things, create electronic procurement networks for small purchases, encourage procurement of off-the-shelf products and services, and establish a program to test innovative procurement practices. To assure equitable Federal procurement, the small-business community needs to be a full partner in these initiatives. Also see Vice President Gore, op. cit., footnote 4.

A logical first step at the Federal level (and by extension at the State/local levels) is a careful review of electronic service delivery as a "system" to identify all relevant technical standards—current and prospective. Standards are needed for: computer networking (and internetworking); electronic mail; videoconferencing; electronic data interchange; smart and hybrid cards and terminals; kiosks; optical disk formats and software; and electronic document and publishing formats, among others.

Congress and the President could designate a lead executive agency, perhaps NIST, for an electronic delivery standards-setting effort. The standards identified then could be mapped into the existing public-private standards structure to determine where: 1) existing standards are satisfactory or need to be modified; 2) standards-setting is underway but should be accelerated; and 3) standards-setting needs to be initiated. NIST could convene forums on electronic delivery technologies, such as kiosks, so that manufacturers, software developers, and users (including Federal users) could collectively identify ways to fill gaps in current standards.

REVISING STATUTES ON SERVICE DELIVERY

Full implementation of electronic delivery would, in many cases, require revision of public laws that establish and define the services being delivered. Widespread electronic benefits transfer, for example, would need clarification of the rights and responsibilities of providers, intermediaries, and recipients of electronic food stamps, WIC food supplements, medical expense reimbursements, and the like. The use of kiosks or home computer terminals for obtaining Federal training services (e.g., from the Department of Labor) or agricultural research services (e.g., from the USDA Extension Service) could result in changes in legal definitions of who provides the specified Federal services and how.

Statutory revisions needed to accommodate electronic delivery would be further complicated by pending or planned Federal agency reorganizations. The Secretaries of Agriculture, Education, Labor, and Housing and Urban Development, for example, all have indicated their intent to use information technology as one of the tools for reorganizing their departments. Detailed planning will take months, but any significant changes in the agency and programmatic structures most likely would—and should—affect the deployment of electronic service delivery. Information technology offers many potential opportunities to support agency reorganization and streamlining.

Fine-tuning or revising program and service delivery statutes would, in sum, require consideration of: 1) the current or revised governmentwide information and telecommunication policy statutes that apply to electronic delivery; 2) current or revised statutes and directives that apply to information technology management; 3) pending or planned agency reorganizations; and 4) pending or planned major programmatic changes that would affect the services delivered—electronically or otherwise. Making the statutory revisions necessary to accommodate electronic delivery could be difficult, given the complex set of laws, policies, plans, and directives that may be relevant. In order to expedite the process as much as possible, a policy analysis component could be included in electronic delivery pilot projects and pre-operational tests, as is being done with, for example, the EBT projects and tests sponsored by USDA (see ch. 4).

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[72] For a general overview of standards-setting processes and options for improvement, see U.S. Congress, Office of Technology Assessment, *Global Standards: Building Blocks for the Future*, OTA-TCT-512 (Washington, DC: U.S. Government Printing Office, March 1992).

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Appendix B: List of Acronyms and Terms

AFDC—Aid to Families With Dependent Children
ACH—Automated Clearing House
analog— information transmitted using a continuously varying signal—e.g., radio transmission
ANSI—American National Standards Institute
ATM—automated teller machine
AUP—Acceptable Use Policy (for the Internet)
backbone—a set of links to carry messages between telecommunication switches
bandwidth—the range of frequencies or maximum information (in bits per second) that a system can transmit
BBS—electronic bulletin board system
BISDN—broadband integrated services digital network
broadband—systems that can transmit relatively large amounts of information, e.g., high definition television
BST—Big Sky Telegraph
CBO—Congressional Budget Office
CD-ROM— compact disk—read-only memory
CIC—Consumer Information Center
CIO—Chief Information Officer
CoREN—Corporation for Regional and Enterprise Networking
CRS—Congressional Research Service
CSL—Computer Systems Laboratory
DHHS—U.S. Department of Health and Human Services
digital—information transmitted using two discrete levels (high and low) and therefore less susceptible to small signal variations
DLP— Depository Library Program
DTIC—Defense Technical Information Center
EBT—electronic benefits transfer
EDI—electronic data interchange
EFT—electronic funds transfer
EFTA— Electronic Funds Transfer Association
EPA— Environmental Protection Agency
ESNet— Department of Energy's energy science network
Fax—facsimile
FedWorld—A bulletin board service maintained by NTIS that, in turn, accesses over 100 other government bulletin boards.
FBI—Federal Bureau of Investigation
FCC—Federal Communications Commission
FILS—Federal Information Locator System
FMS—Financial Management Service
FNS—Food and Nutrition Service
FOIA—Freedom of Information Act
frame relay—an electronic format for sending packets
FSP— Food Stamp Program
FTS—Federal Government's telecommunications program previous to FTS2000
FTS2000—Federal Government's long-distance telecommunication services program
GAO—U.S. General Accounting Office
GPO—U.S. Government Printing Office
GIS—Geographic Information System
GSA—U.S. General Services Administration
HPCC—High Performance Computing and Communications program
hybrid card—a card using both a microprocessor and a magnetic stripe
I&R—Information and Referral (offices)

Internet—a family of interoperable computer networks

InterNIC— Internet Network Information Center

interoperability— the ability of one system to communicate with or operate with another

IRM—Information Resources Management

IRMS—Information Resource Management Service

ISDN—integrated services digital network

kbps—kilobits per second

kilobit—1,000 bits

LATA—local access and transport area

LAN—local area network

LEC—local exchange carrier (the traditional local telephone company)

Magnetic stripe card—a card with a magnetic stripe on the back—e.g., most bank or credit cards

Megabyte—1 million bytes (8 million bits)

Mbps— megabits per second

NAPA—National Academy of Public Administration

NARA—National Archives and Records Administration

NASA—National Aeronautics and Space Administration

narrowband—systems that transmit relatively small amounts of information, e.g., telephone conversations

NII—National Information Infrastructure

NIST—National Institute of Standards and Technology

NLM—National Library of Medicine

NOAA—National Oceanic and Atmospheric Administration

NPTN—National Public Telecomputing Network

NREN—National Research and Education Network

NSF—National Science Foundation

NSFNET—National Science Foundation network

NSA—National Security Agency

NSI—NASA Science Internet

NTIA—National Telecommunications and Information Administration

NTIS—National Technical Information Service

Off-line—not connected directly to a central computer—e.g., connections may be made at a later time

OIRA—Office of Information and Regulatory Affairs

OMB—Office of Management and Budget

on-line— connected directly to a central computer either permanently or through a dial-up connection

OSTP— Office of Science and Technology Policy

packet—a set of data transmitted in a predetermined format and with an accompanying address

PCN— personal communication network

PCS—personal communication services—any of the many mobile services designed to serve individuals wherever they are

PEN—Public Electronic Network, Santa Monica, CA

PIN—personal identification number

POTS— plain old telephone service

POS—point-of-sale

PRA— Paperwork Reduction Act

RAN—rural area network

REA—Rural Electrification Administration

RFI—request for information

RFP—request for proposals

SeniorNet—a not-for-profit organization that provides computer services to senior citizens

SIGCAT— Special Interest Group on CD-ROM Applications and Technology

Smart card—a card the size of a bank card with an embedded microprocessor

SS7— common channel signaling system 7

SSA—Social Security Administration

SSI—Supplemental Security Income Program

SupDocs—Superintendent of Documents

T1—protocol for sending data at 1.544 Mbps

T3— protocol for sending data at 45 Mbps

TCP/IP— transport control protocol/internet protocol—the electronic format used for Internet messages

TDD— Telecommunications Devices for the Deaf

TRI— Toxic Release Inventory

Tulare Touch—electronic kiosk system used in Tulare County, CA for its welfare eligibility program

USDA—U.S. Department of Agriculture

VA—U.S. Department of Veterans Affairs

VAN—value- added network

WAIS—wide area information servers

WIC—Special Supplemental Food Program for Women, Infants and Children

WORM—write-once, read-many times optical disk

WEDI—Workgroup for Electronic Data Interchange

WyoCard—State of Wyoming's pilot project to deliver WIC benefits

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Appendix E: Contractor Reports and OTA Trip Reports Prepared for This Assessment

Copies of contractor reports prepared for this study will be available in late 1993 through the National Technical Information Service (NTIS), either by mail (U.S. Department of Commerce, National Technical Information Service, Springfield, VA 22161) or by calling NTIS directly at (703) 487-4650.

Steve Arnold, "Investing in an Information Infrastructure: An Overview of Japan's Network Services," January 1993.

Richard Civille, Computer Professionals for Social Responsibility, "Broadening the Research Community: Delivering Federal Services Using Information Technology," December 1992.

William H. Dutton, Annenberg School for Communication, "Electronic Service Delivery and the Inner City: Community Workshop Summary," December 1992.

William H. Dutton and K. Kendall Guthrie, "State and Local Government Innovations in Electronic Services: The Case in the Western and Northeastern United States," Dec. 12, 1991.

Stephen Frantzich, Congressional Data Associates, "Electronic Service Delivery and Congress," January 1993.

John C. Gale, Information Workstation Group, "Multimedia Systems for Electronic Service Delivery," Jan. 25, 1993.

Thomas M. Grundner, National Public Telecomputing Network, "The OTA/NPTN Teleforum Project: An Experiment With a Multi-City 'Electronic Town Hall,'" January 1993.

Susan G. Hadden and W. James Hadden, Jr., Intelligent Advisors, Ltd., "Government Electronic Services and the Environment," November 1992.

John Harris and Alan F. Westin, Reference Point Foundation, "Non-Profit and Academic Applications of Computer and Telecommunication Technologies," December 1991.

John Harris, Alan F. Westin, Anne L. Finger, Reference Point Foundation, "Innovations for Federal Service: A Study of Innovative Technologies for Federal Government Services to Older Americans and Consumers," February 1993 .

J. Scott Hauger, "Ensuring the Accessibility of New Technologies for the Electronic Delivery of Federal Services for Persons With Disabilities," Jan. 20, 1993.

Charles R. McClure, Rolf T. Wigand, John C. Bertot, Mary E. McKenna, William E. Moen, Joe Ryan, and Stacy B. Veeder, "Federal Information Policy and Management for Electronic Service Delivery," Dec. 21, 1992.

Jack M. Nilles, "Energy/Environmental Impacts of Electronic Service Delivery: Trends and Innovations," November 1991.

Frank Odasz, Big Sky Telegraph, "Computer Conference on Electronic Service Delivery to Rural/Small Town America," Jan. 8, 1993.

Office of Technology Assessment, Trip Reports to Alaska; California; Montana/Wyoming; and Olympia/ Seattle, WA; Nov. 10, 1992

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